

STRUCTURE OF THIS MICROCARD (BASIC INSTRUCTIONS)

A02 = How to use this microcard		1	2	3		4
A01 = Structure of microcard					SIS	
B01 = Trouble-shooting chart	A	***X*	X*XXX	XXXXX	XXXXX	*XXXX X
	B	*XXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	C	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	D	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	E	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XX
	F	XXXXX	XXXXX	XXXXX	XXX	
	G	XXXXX	XXXXX	XXXX		
	H					
	J					
	K					
	L					
	M					
N01 = Service information	N	*XXXX	XXXXX	XXXXX	XXX	*X XX*
		12345	67890	12345	67890	12345 678
			1		2	

N28 = Table of contents and publication information

Index

1 = Special features
2 = Safety and precautionary measures
3 = Testers and tools
4 = Installation position of components

- a. Read from left to right.
- b. Title of micropicture (appears on each micropicture).

E16	Product/component/test step	
	Coordinate	

c. Limits of section

<u>=></u>	<u><=></u>	<u><==</u>	<u>=> <=</u>
Beginning	Mid-section	End	One-page section

A01		=> <=
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HOW TO USE THIS MICROCARD

Trouble-shooting instructions for system

EI

Descriptions, photographs, terminal designations and special features refer to the following vehicle:

OPEL SENATOR-B 3.0 1
3.0 1 /6-cyl. engine 30 NE 1.88 ->

These basic instructions are comprehensive trouble-shooting instructions. They must not be used as vehicle-specific instructions. Caution! Descriptions and photographs may deviate from the vehicle-specific brief instructions.

Mandatory set values, terminal assignments and special features should be taken from the vehicle-specific brief instructions only. For brief instructions, see table of contents Microcard KFZ-00..

A02		=> <=
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SPECIAL FEATURES

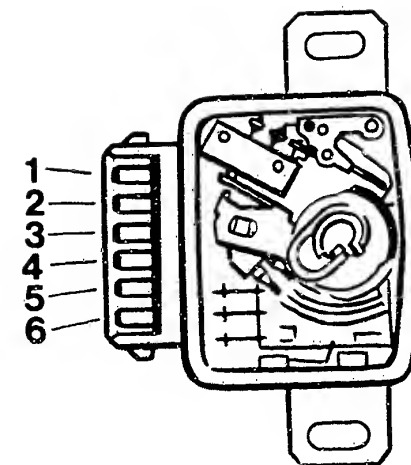
Basic ignition setting on vehicles with transmission control

For precise load detection, the transmission control (TC) requires a throttle-valve potentiometer which is integrated into the throttle-valve switch (6-pole version). See picture.

For the purposes of basic ignition setting, the 6-pole plug must be disconnected at the throttle-valve switch and terminals 4, 5 and 6 shorted (jumped).

The self-diagnosis feature in the transmission control unit recognizes the detaching of the throttle-valve plug as being a fault and stores it as fault code 21 (throttle-valve potentiometer, voltage too high) in the fault memory.

For this reason, the fault memory in the transmission control unit must be cleared after every basic ignition setting.
To do so, disconnect negative terminal of battery for approximately 1 minute.



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SAFETY AND PRECAUTIONARY MEASURES

Be sure to observe safety and precautionary measures so as to avoid risk to persons and to prevent damage to the engine, trigger boxes, control units or the ignition system.

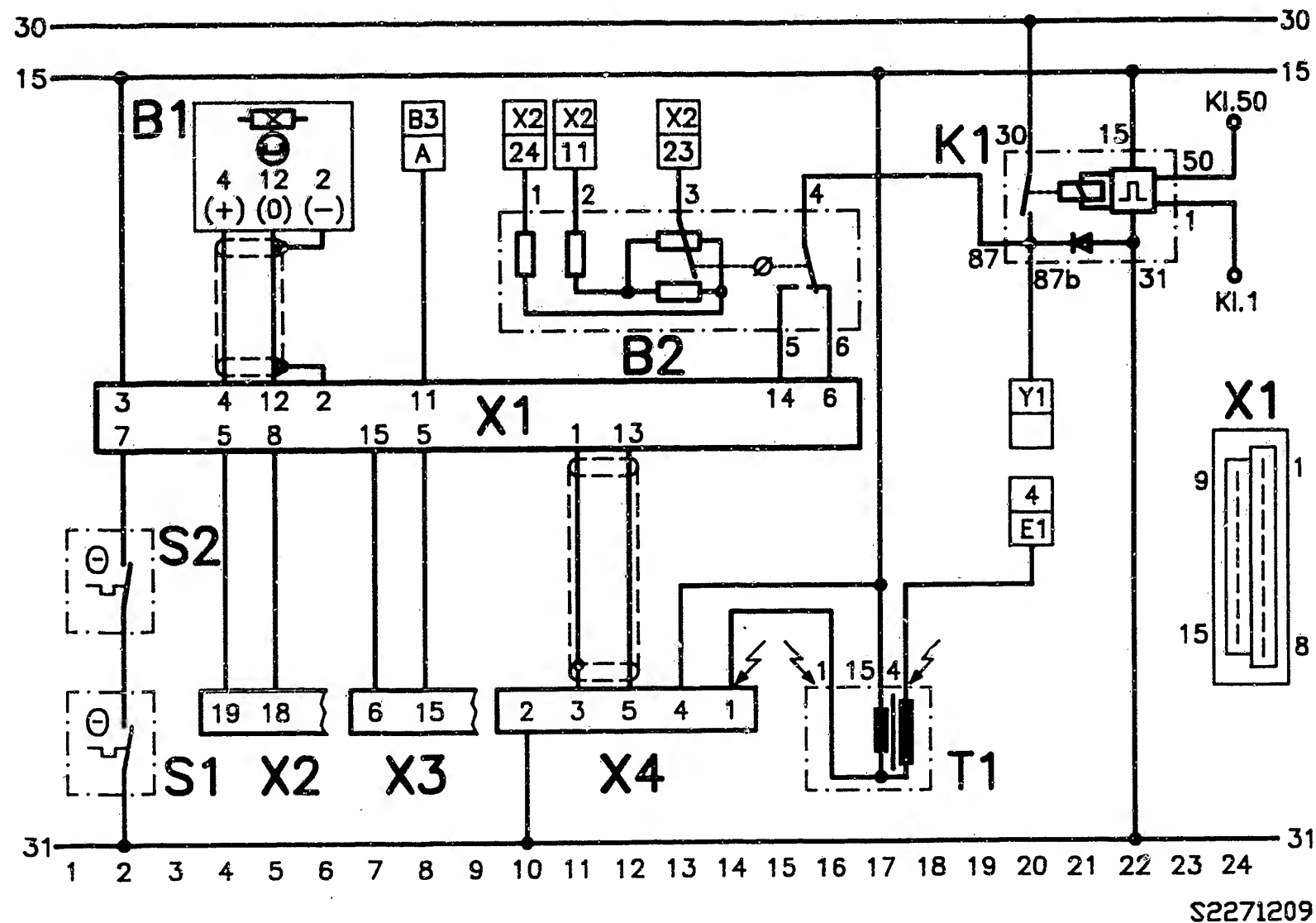
CAUTION!

High-energy ignition system with dangerous high and low voltages!

Touching live parts or terminals may be highly dangerous (both on the primary and secondary sides).

In this connection we should like to point out that VDE Regulations (in particular VDE 0104/7.67) and the pertinent local regulations are to be adhered to when performing work on or testing the ignition system.

For production reasons:
continued on the following
coordinate.



High-tension arrows: Caution 400 V...25 kV

T1 = Ignition coil

X4 = Trigger-box plug

SAFETY AND PRECAUTIONARY MEASURES (CONTINUED)

Taking the terminal diagram of an electronic ignition system as an example, the hazardous locations are marked with high-tension arrows.

SAFETY AND PRECAUTIONARY MEASURES
(CONTINUED)

Never start engine without battery securely connected (battery terminals tightened).
Do not disconnect battery from vehicle electrical system with engine running.

Do not use a fast charger for starting the engine.
Provide starting assistance only with second 12 V battery and jump leads.
Caution! Owing to non-standardized requirements of vehicle manufacturers with regard to electronic products, we advise against using a 24 V battery for starting assistance.

When charging the battery in the vehicle or providing starting assistance, follow the operating instructions for the fast charger as well as instructions of the vehicle manufacturer.

Disconnect battery from vehicle electrical system before charging or fast-charging.

Incorrect polarity of the supply voltage, e.g. through incorrect connection of the battery or ignition coil, may lead to the destruction of a control unit.

Do not connect or disconnect wiring-harness plugs from control units or trigger boxes with the ignition on.

Remove control units at temperatures above + 80° C (paint-drying installation).

Remove control units before carrying out electric welding work.

SAFETY AND PRECAUTIONARY MEASURES
(CONTINUED)

When testing compression, detach trigger-box plug or permanently connect ignition coil term. 4 to ground with auxiliary cable (hazardous high tension, insulation damage on ignition coil, ignition distributor, ignition harness).

Note:

Auxiliary cable must feature at least 2 k Ω interference suppression, e.g. sleeve-type suppressor (5 k Ω)
0 356 500 001.

Prescribed ignition coil (see part no.) is not to be replaced with a different ignition coil.

An interference-suppression capacitor is not to be connected to term. 1 of the ignition coil.

The positive terminal of the battery is never to be connected to term. 1 of the ignition coil as this will destroy the trigger box.

Do not short-circuit term. 1 of ignition coil to ground (e.g. to switch off engine), as this will destroy the ignition coil and possibly also the trigger box.

Ignition cable from ignition coil and ignition distributor term. 4 must not be detached during operation.

There must be no voltage flashover from term. 4 of the ignition coil to term. 1 and term. 15 of the ignition coil.

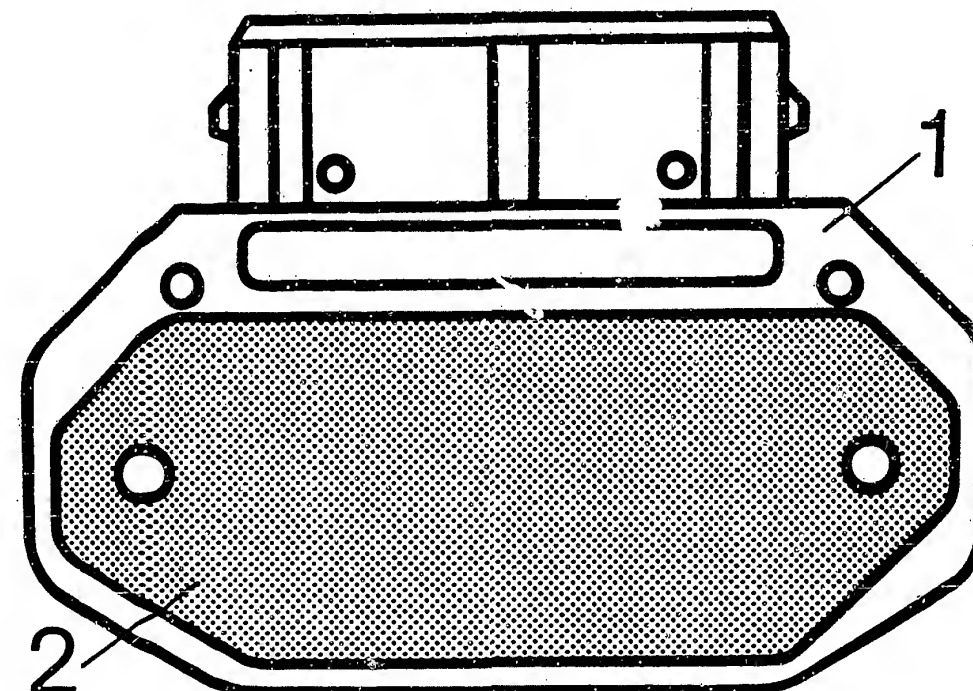
The secondary side of the ignition system must feature at least 2 k Ω interference suppression, so as to prevent destruction of the trigger box. The original distributor rotor must be fitted with 1 k Ω .

SAFETY AND PRECAUTIONARY MEASURES
(CONTINUED)

Incorrect indication of engine speed, dwell angle and ignition point:

With this ignition system (trigger box with current limitation) there is a possibility of an incorrect indication of engine speed, dwell angle and ignition point on testers.

Refer to coordinates N10...N13 for more detailed information



227/092

1 = Trigger box

2 = Base

SAFETY AND PRECAUTIONARY MEASURES
(CONTINUED)

The base must be coated with thermal conduction compound before installing the trigger box.

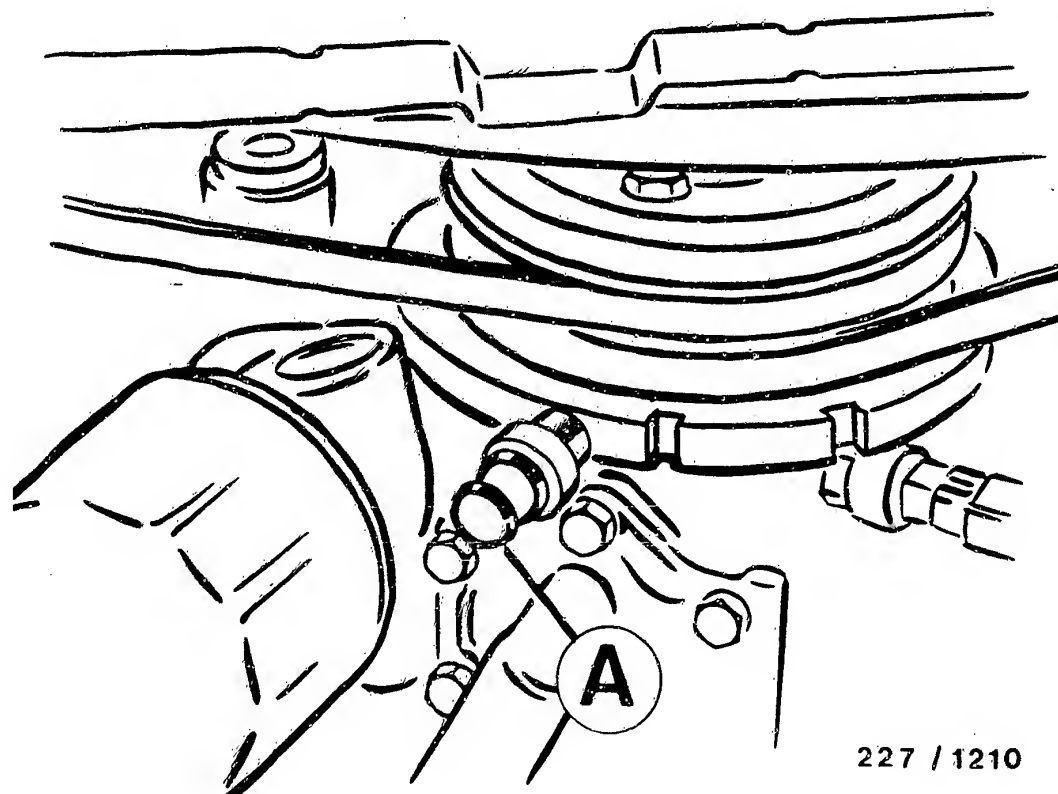
Only apply thermal conduction compound with a suitable implement (screwdriver, match etc.).
Do not apply thermal conduction compound to painted parts.

TESTERS AND TOOLS

Motortester e.g. Mot 206	0 684 000 206
<hr/>	
Pulse-shaping circuit (required for measurement of primary voltage with MOT 201, 206 and 400)	1 684 463 154
<hr/>	
TDC sensor	1 687 224 633 .. 655
<hr/>	
Sleeve-type suppressor 5 k Ω	0 356 500 001
<hr/>	
Ohmmeter ETE 014.00 or e.g. Pontavi Wh 2	0 684 101 400 Comm. avail.
<hr/>	
Voltmeter e.g. ETE 014.00	0 684 101 400
<hr/>	
Test leads (for proper connection of testers to connec- tors)	KDZS 0004 KDZS 0005
<hr/>	
Black test prod	1 684 485 034
Red test prod (for proper connection of testers to connectors)	1 684 485 035
<hr/>	
Connecting cable for ignition coil (for term. 1 green)	1 684 443 055
Connecting cable for ignition coil (for term. 15 yellow)	1 684 443 054
<hr/>	

TESTERS AND TOOLS (CONTINUED)

Thermal conduction compound	5 942 860 003
<hr/>	
2 auxiliary leads (user- produced) consisting in each case of approx. 90 mm cable 1.5 mm ²	6 210..
<hr/>	
4 blade terminals e.g.	8 784 480 011
<hr/>	
Auxiliary lead (user- produced) consisting in each case of approx. 200 mm cable 0.75 mm ²	6 210..
<hr/>	
4 blade terminals (2.8 x 0.8)	KDZS 0004/1
<hr/>	

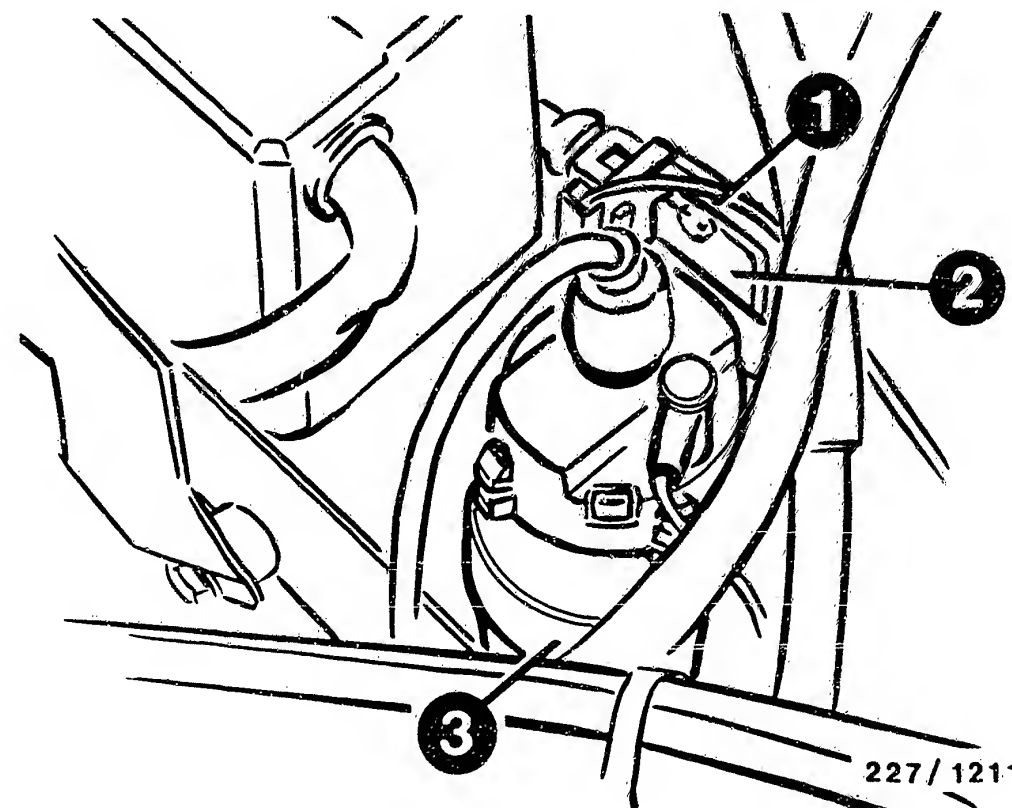


227 / 1210

A = Plug for TDC sensor

INSTALLATION POSITION OF COMPONENTS

Motor tester (TDC sensor) connection:
Remove plug "A" (see picture) and insert TDC sensor as far as it will go into sleeve of control housing.

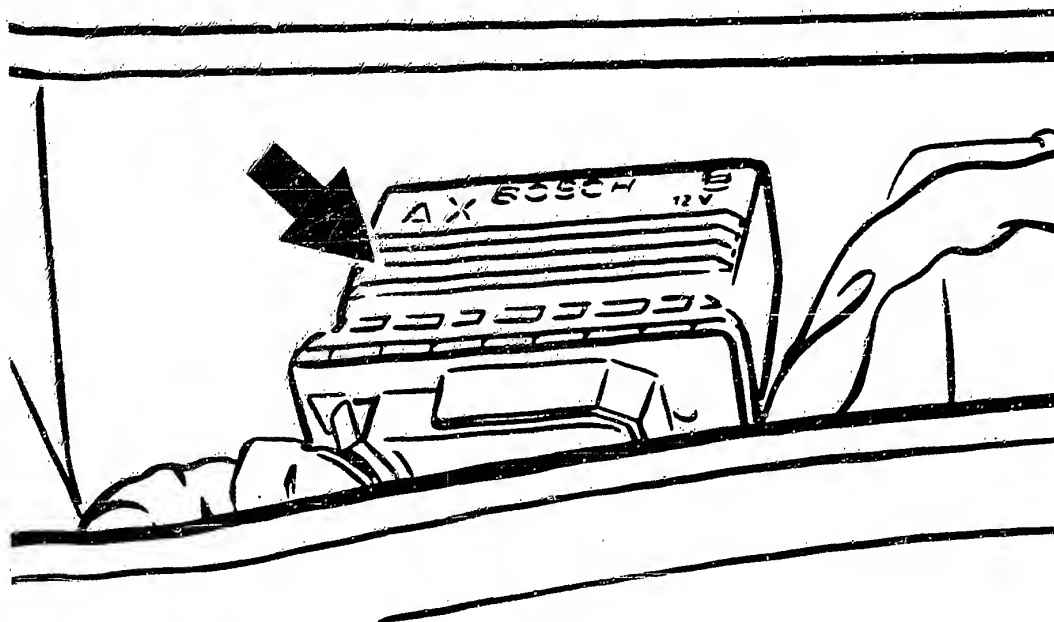


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- 1 = TI trigger box
- 2 = Heat sink
- 3 = Ignition coil

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The trigger box and ignition coil are installed on a joint heat sink. See picture.



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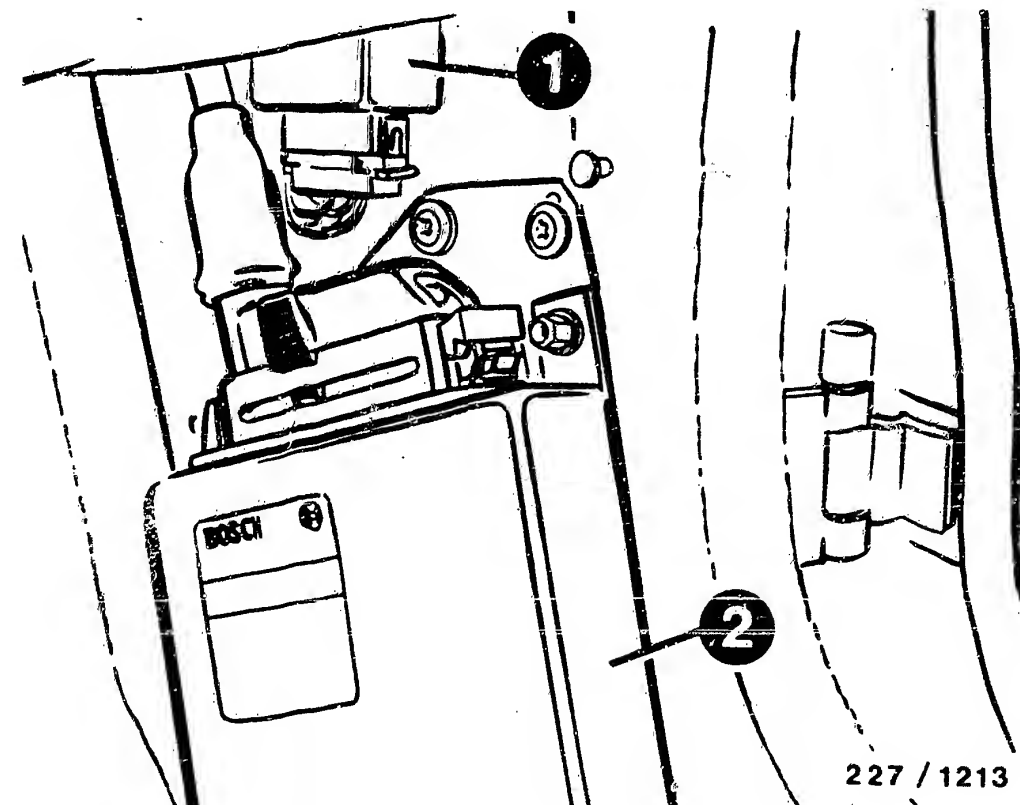
Arrow = Ignition advance unit

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The ignition advance unit is located on the right-hand side of the vehicle. See picture.

Removal:

Raise cover of plenum chamber.
Unscrew fastening nuts.
Press back retaining spring, tilt and remove plug.



227 / 1213

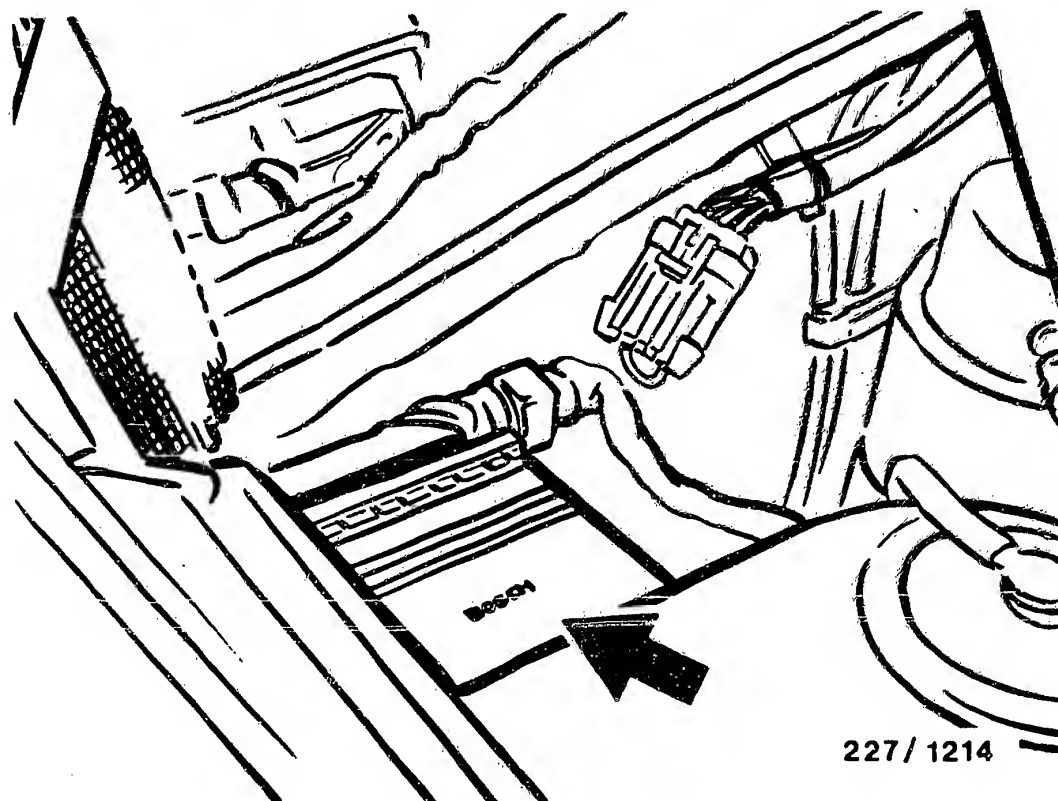
1 = Control unit for centralized locking system
2 = LE-Jetronic control unit

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The LE-Jetronic control unit is located at the side wall, front right. See picture.

Removal:

Remove side wall (plug connection).

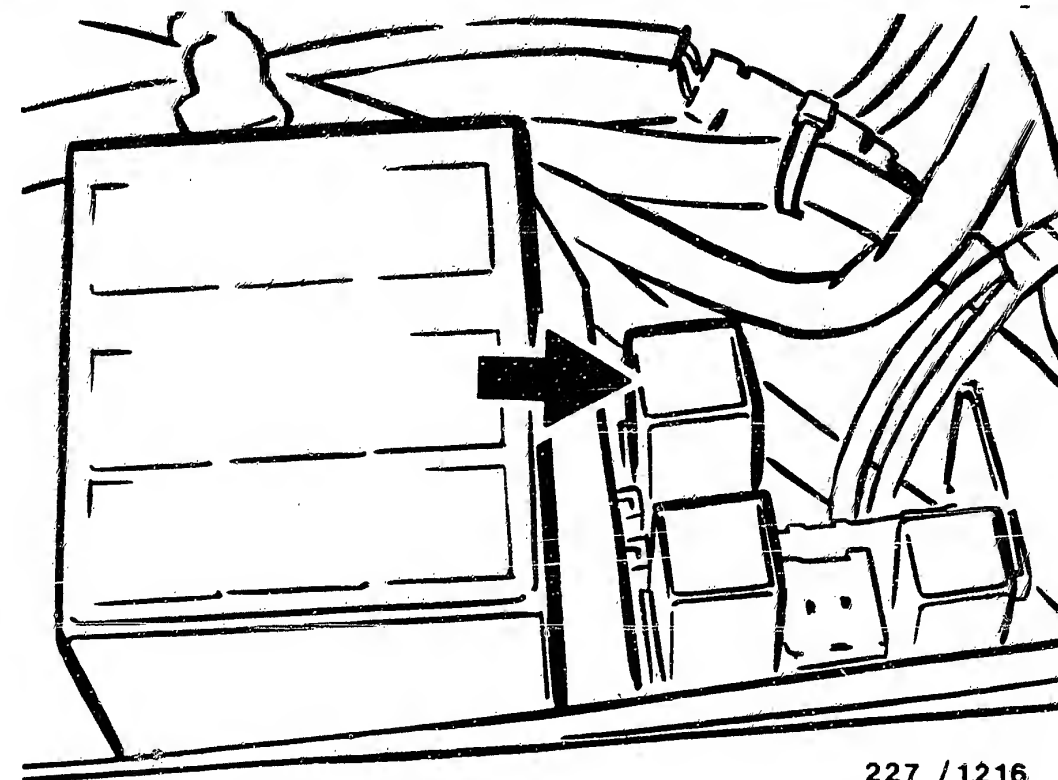


227/1214

Arrow = Transmission control (TC) - control unit

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The control unit is located on the right of the engine compartment between spring-strut dome and bulkhead. See picture.



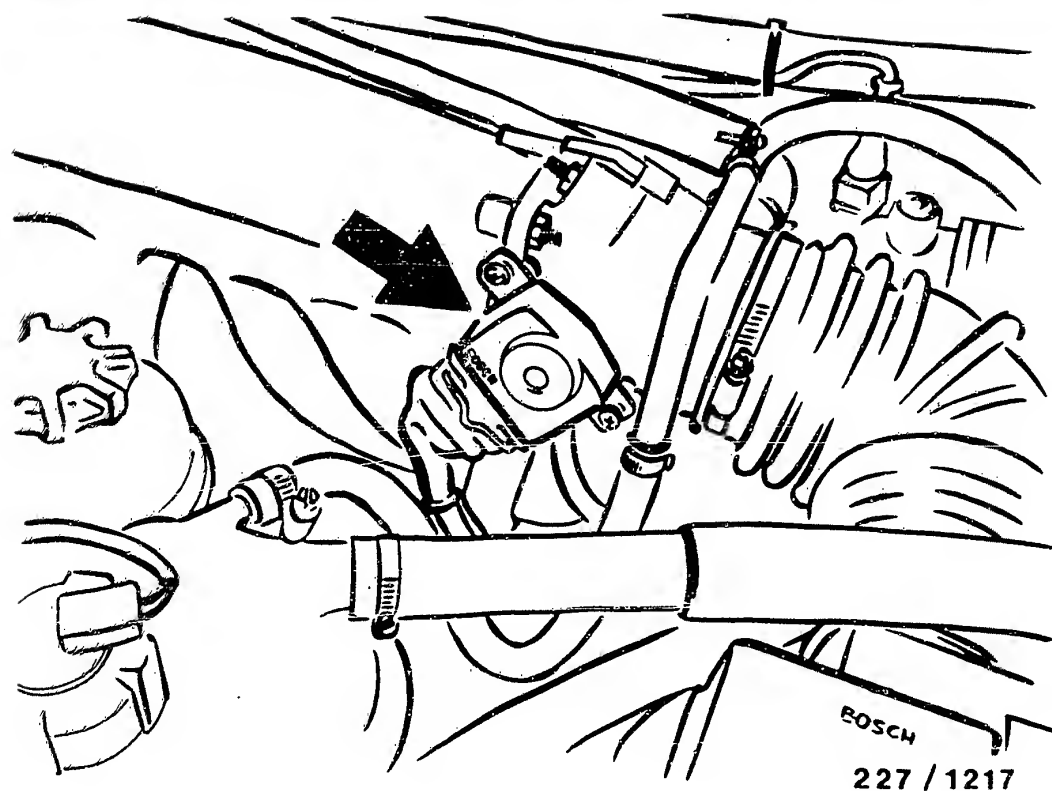
227/1216

Arrow = Control relay (LE-Jetronic)

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

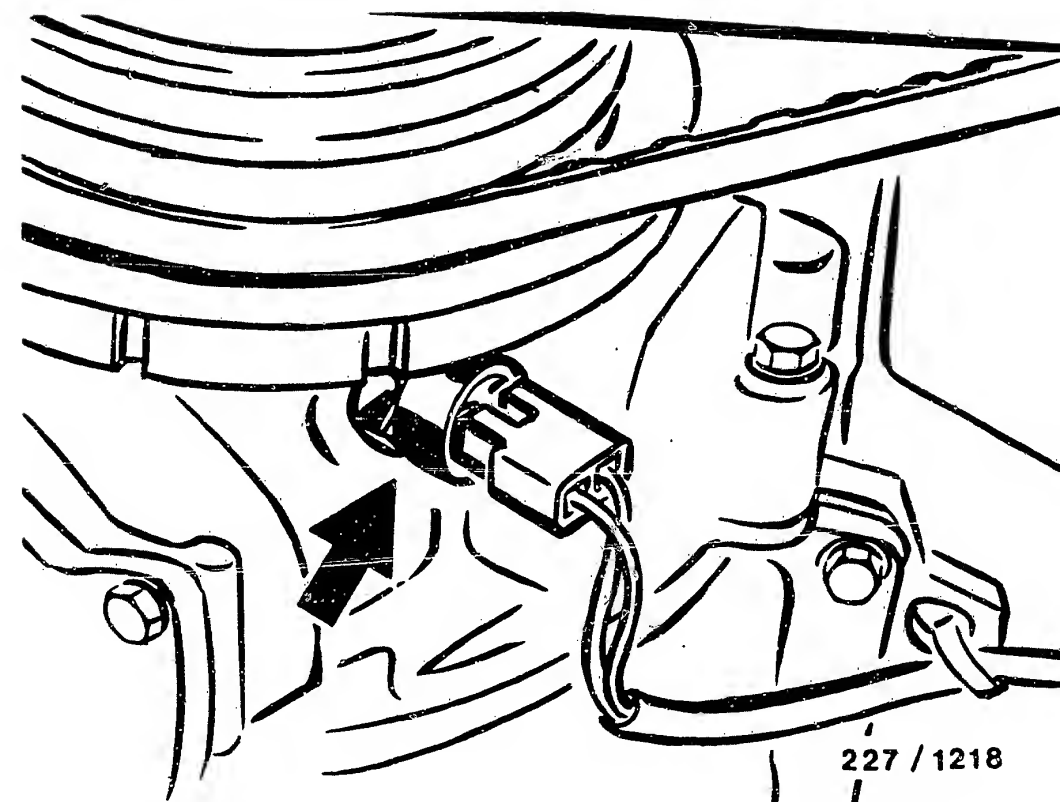
The control relay is located in the relay plate (on left of engine compartment). See picture.

Note: The control relay may be installed in a differing sequence in the relay plate (characteristic feature, black frame).



Arrow = Throttle-valve switch with potentiometer

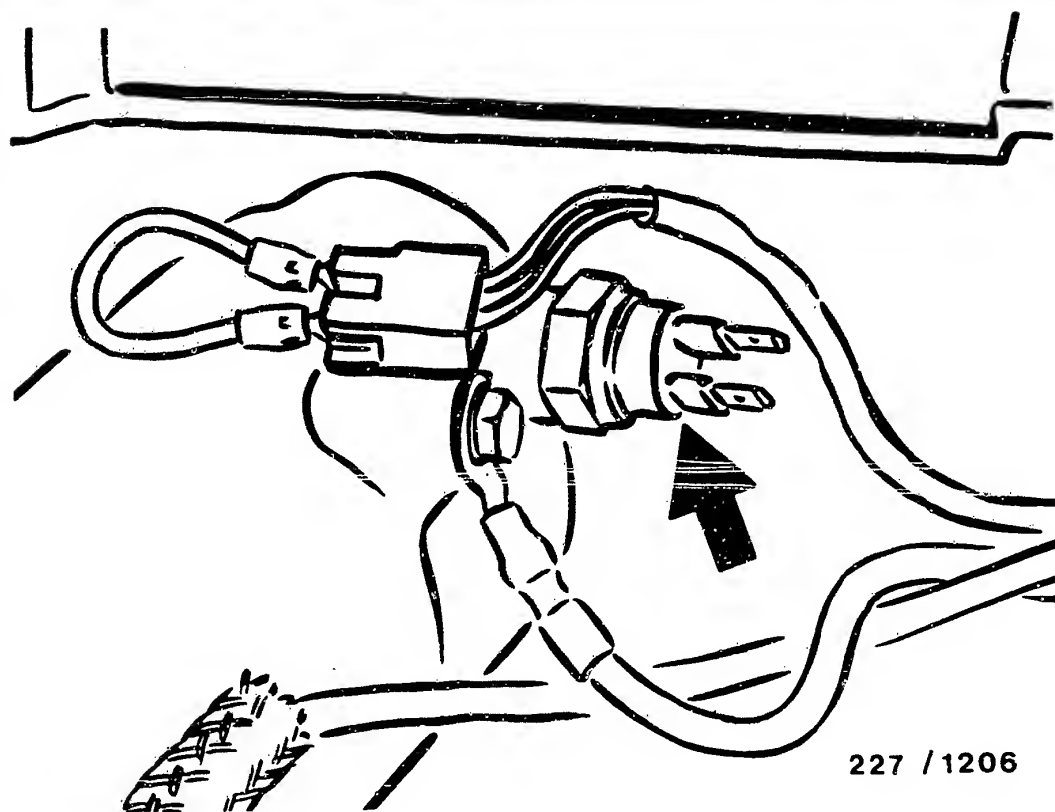
INSTALLATION POSITION OF COMPONENTS (CONTINUED)



Arrow = Temperature switch (oil)

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The temperature switch is located at the front left of the engine (crankshaft pulley).
Tightening torque: 25 Nm.



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Arrow = Temperature switch (intake manifold)

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

For production reasons:
continued on the following
coordinate.

HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM

The TROUBLE-SHOOTING CHART starts with Coordinate B04 and contains customer complaint (fault symptom/fault characteristic feature) together with several possible causes in each case (component faults) and coordinate information for detailed trouble-shooting. If no coordinates are given, this is because the causes concerned do not require any test instructions.

In the event of a clearly established customer complaint, proceed consecutively and step by step as indicated in the trouble-shooting instructions in the stated sequence of possible causes.

Trouble-shooting should always be commenced with self-diagnosis (if provided) or with the universal test adapter (if envisaged). Only then should trouble-shooting be continued in line with the trouble-shooting chart.

In the event of a customer complaint which is not clear-cut, all causes indicated in the trouble-shooting chart must be tested. In order to avoid incorrect measurements, all causes are to be checked in the specified sequence (on account of interlinkage of test steps).

HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM (CONTINUED)

The TROUBLE-SHOOTING PROGRAM contains all system and component tests indicated in the trouble-shooting chart. It is sub-divided into three rows of boxes.

The left-hand column contains test instructions and set values.

The center column contains information on trouble-shooting and fault elimination.

The right-hand column contains pictures/connection diagrams linked to the text together with explanatory notes.

If the questions posed in the left-hand column can definitely be answered with "yes", trouble-shooting is to be continued with the next box below.

If the answer to the question is "no", the center column must be applied and the tests performed in the sequence indicated there.

Following fault elimination, repeat test as a check.

HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM (CONTINUED)

TEST PREREQUISITES:

- Battery fully charged
- Engine in proper mechanical working order (e.g. compression, valve clearance etc.)
- Engine at operating temperature of approx. +80°C (if necessary)
- Proper connection of all connectors of wiring harness

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on.
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

										Cause (component fault)	Coord.
*			*							High-tension side	B07
*										Firing sequence	
*			*							Ignition coil	B09
*										Ignition-distributor installation setting	B11
*										Trigger-box voltage	B13
*										Primary-circuit voltage	B15
*										Ignition-distributor plug and socket	B17
*										Magnetic-pulse-generator voltage	B19
*										Magnetic-pulse-generator function	B21
*										Ignition-advance-unit function	B23
*										Contact resistance (primary side)	B27
*										Engine-speed signal	C03
*										Primary signal	C05
*	*	*		*	*		*	*		Basic ignition setting	C07
				*	*					Control lead, character- istic-curve control	C11

TROUBLE-SHOOTING CHART (CONTINUED)

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

										Cause (component fault)	Coord.
			*	*						Temperature switch (oil)	C13
			*	*						Temperature switch (intake manifold)	C15
	*	*	*	*						Throttle-valve switch (idle/full load)	C17
			*	*						Load signal	C21
			*							Trigger-box voltage (engine idling)	C25
			*							Ignition-coil voltage (engine idling)	C27
			*							Primary voltage (engine idling)	D01

For production reasons:
continued on the following
coordinate.

TROUBLE-SHOOTING PROGRAM (1)

V

Test high-voltage side.

N>

Repair high-voltage side.

Test spark plugs, spark-plug connectors, suppression resistors, H.T. ignition cables, distributor cap, distributor rotor etc. for proper operation (e.g. open circuit, shunt).

Assessment e.g. through ignition oscillogram, resistance measurements and visual check.

High-voltage side O.K.?

Y

V

Return to trouble-shooting chart
B04

B07

==>

B08

<==

TROUBLE-SHOOTING PROGRAM (2)

Check ignition coil

Visual examination:

Remove protective cap from ignition coil and check whether plug is in position and whether sealing compound has escaped.
See picture.

Electrical check:

Ignition coil primary term. 15 and term. 1

(Take resistance of test lead and test prods into account)

Set value: see brief instructions

Ignition coil secondary term. 1 and term. 4

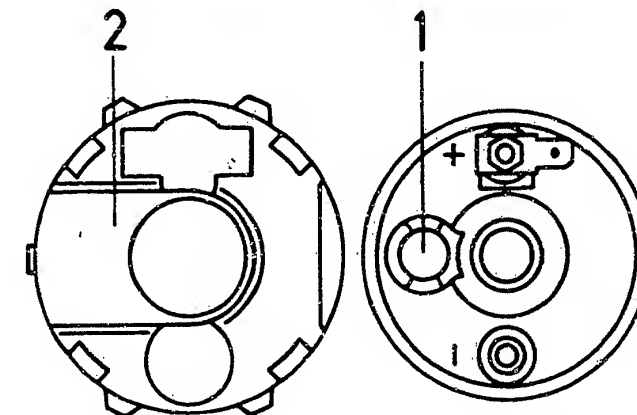
Set value: see brief instructions

Visual examination O.K./set value obtained?

N>

1. If there is no plug or if sealing compound has oozed out, renew ignition advance unit, as well as trigger box and ignition coil.

2. If set values are not O.K., renew ignition coil.



227/0055

1 = Plug
2 = Protective cap

Return to trouble-shooting chart
B04

B09

<=>

B10

<=>

TROUBLE-SHOOTING PROGRAM (3)

Test ignition-distributor installation setting.

N>

Adjust ignition distributor.

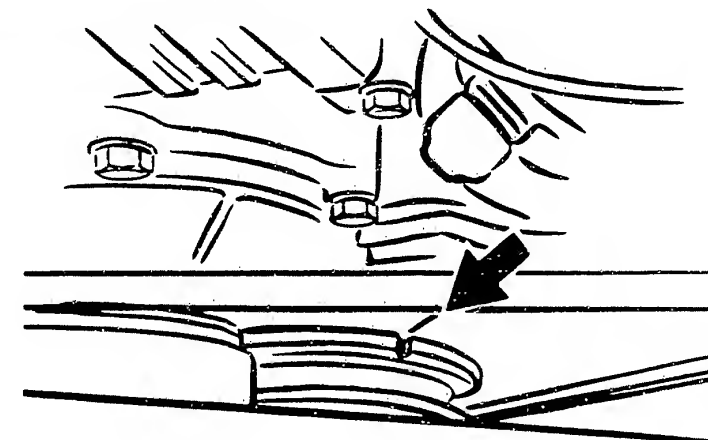
Set crankshaft cyl. 1 to pulley mark (10° v. BTDC).
See top picture.

Remove cap, distributor rotor and dust-protection cover from ignition distributor.

Attach distributor rotor.

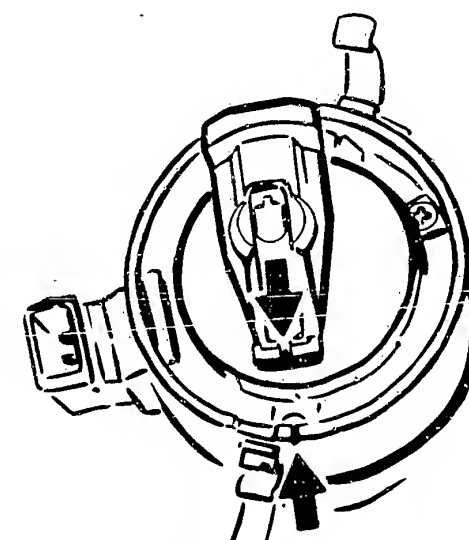
The distributor rotor must be set such that the center of the distributor-rotor electrode faces the housing mark, cyl. 1.
See bottom picture, arrow.

Ignition-distributor installation setting O.K.?



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Return to trouble-shooting chart B04



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B11

<=>

B12

<=>

TROUBLE-SHOOTING PROGRAM (4)

Test trigger-box voltage.

Detach trigger-box plug and connect voltmeter to term. 4 (+) and term. 2 (-).
See picture.

Switch on ignition.

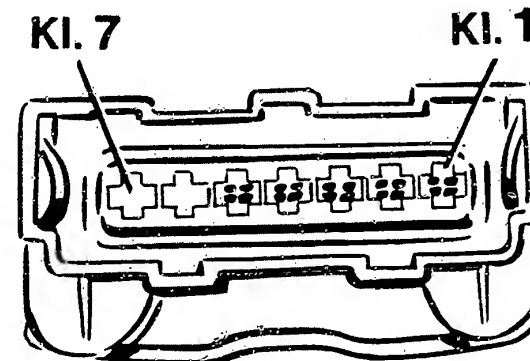
Set value: battery voltage

Is set value attained?

N>

Check for open circuit in leads and connections between ignition/starting switch and trigger-box plug term. 4 including ground lead term. 2.

Eliminate open circuit.



227/580

Return to trouble-shooting chart B04

B13

<==>

B14

<==>

TROUBLE-SHOOTING PROGRAM (5)

Test primary-circuit voltage.

Detach trigger-box plug and connect voltmeter to term. 1 (+) and term. 2 (-).
See picture.

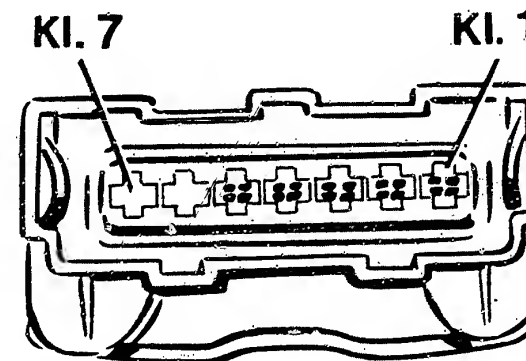
Switch on ignition.

Set value: battery voltage

Is set value attained?

N>

Test for open-circuit in lead from ignition and starting switch to ignition coil term. 15, primary winding of ignition coil and lead from ignition coil term. 1 to trigger-box plug term. 1 including ground lead term. 2.
Eliminate open-circuit.



227/580

Return to trouble-shooting chart
B04

B15

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B16

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TROUBLE-SHOOTING PROGRAM (6)

Test ignition-distributor plug and ignition-distributor socket.

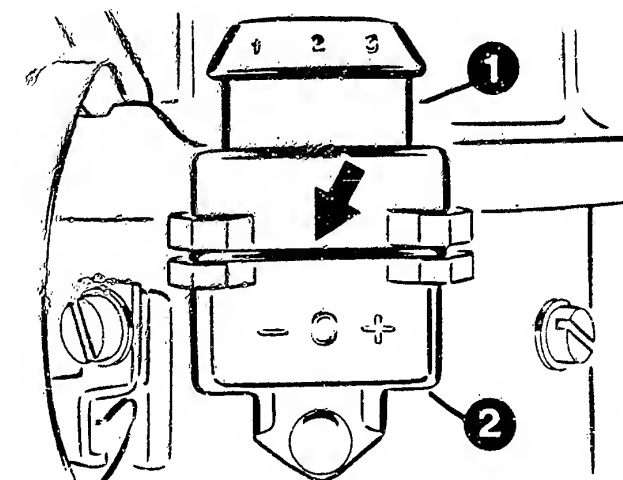
Press wire clip of ignition-distributor plug.
See upper illustration, arrow.

Remove ignition-distributor plug.

Visual examination:
Test contacts of ignition-distributor plug and ignition-distributor socket for oxidation.

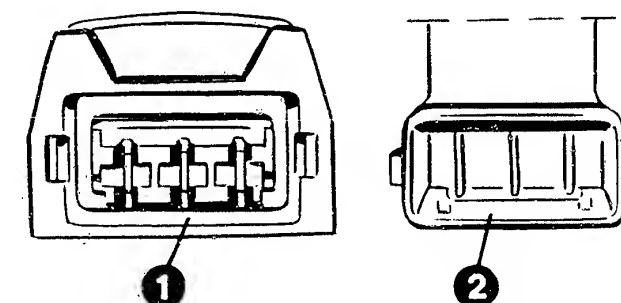
Contacts O.K.?

Eliminate oxidation.



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1 = Ignition-distributor plug
2 = Ignition-distributor socket



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Return to trouble-shooting chart B04

B17

B18

TROUBLE-SHOOTING PROGRAM (7)

Test magnetic-pulse-generator voltage.

Ignition-distributor and trigger-box plug connected.

Push back rubber sleeve of ignition-distributor plug.

Connect voltmeter to ignition-distributor plug term. 4 (+) and term. 2 (-).
See top picture.

Switch on ignition.

Set value equal to /greater than 10 V

Is set value attained?

N>

Disconnect positive terminal of battery.
Detach trigger-box, ignition-distributor and ignition-advance-unit plug.
Consecutively connect ohmmeter to:

- | | |
|------------------------------|---------------------------------------------|
| 1. Ignition-distributor plug | Ignition-advance-unit plug (center picture) |
| Term. 4 and Term. 2 | term. 4 and term. 2 |

Set value approx. 0 Ω in each case (continuity).
Eliminate open-circuit.

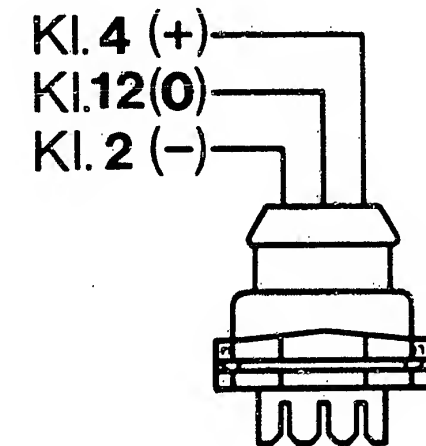
- | | |
|-------------------------------|-----------------------------------|
| 2. Ignition-advance-unit plug | Trigger-box plug (bottom picture) |
| Term. 1 and Term. 3 | and term. 3 |

Set value approx. 0 Ω (continuity).
Eliminate open-circuit.

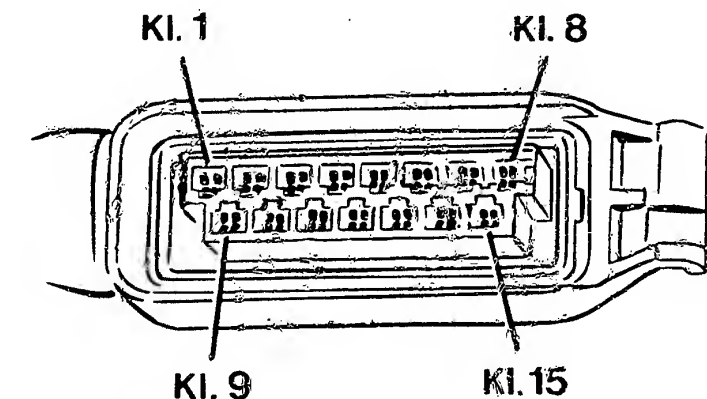
- | | |
|-------------------------------|--------------------------------------|
| 3. Ignition-advance-unit plug | Ignition and starting switch/battery |
| Term. 3 and Term. 15/30 | term. 15/30 |

Set value approx. 0 Ω (continuity).
Eliminate open-circuit.

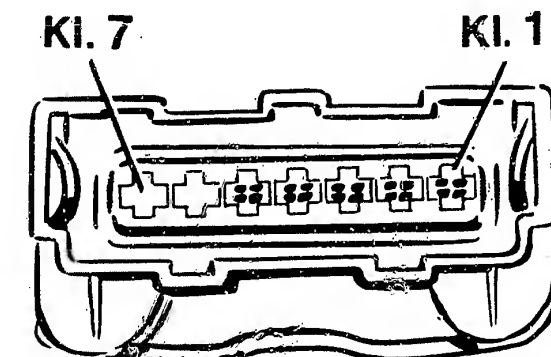
If there was no open-circuit in items 1, 2 and 3, renew ignition advance unit.



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Return to trouble-shooting chart B04

TROUBLE-SHOOTING PROGRAM (8)

Test magnetic-pulse-generator function.

Ignition-distributor, trigger-box and ignition-advance-unit plug connected.

Push back rubber sleeve of ignition-distributor plug.

Connect oscilloscope in program-selector-switch setting "Special" in accordance with operating instructions.

For example MOT 206:

Red clip to ignition-distributor plug term. 12 (measurement signal).
See top picture.
Black clip to vehicle ground.

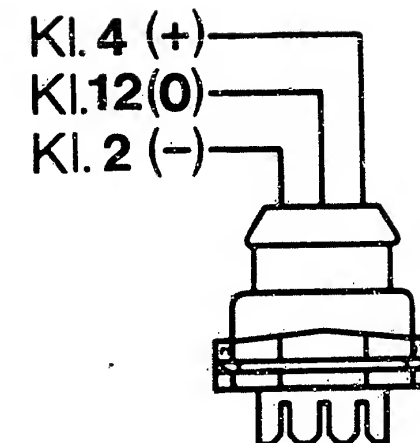
Start engine.

Oscilloscope must indicate rectangular pulse.
See bottom picture.

Rectangular pulse present?

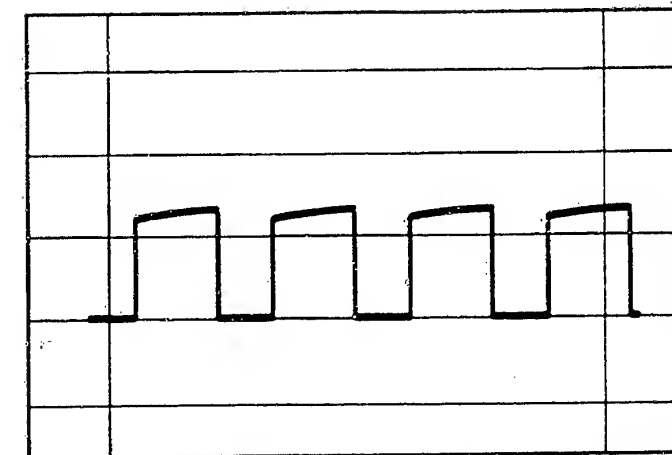
N>

Replace magnetic pulse generator and/or ignition distributor.



227/966

Rectangular pulse



227/0096

Return to trouble-shooting chart B04

B21

<=>

B22

<=>

TROUBLE-SHOOTING PROGRAM (9)

Test ignition-advance-unit function.

N>

Ignition-distributor, trigger-box and ignition-advance-unit plug connected.

Unscrew ignition coil with heat sink.

Push back rubber sleeve of trigger-box plug.

Connect oscilloscope in program-selector-switch setting "Special" in accordance with operating instructions.

For example MOT 206:

Red clip to trigger-box plug term. 5 (measurement signal). See top picture.

Black clip to vehicle ground.

Start engine.

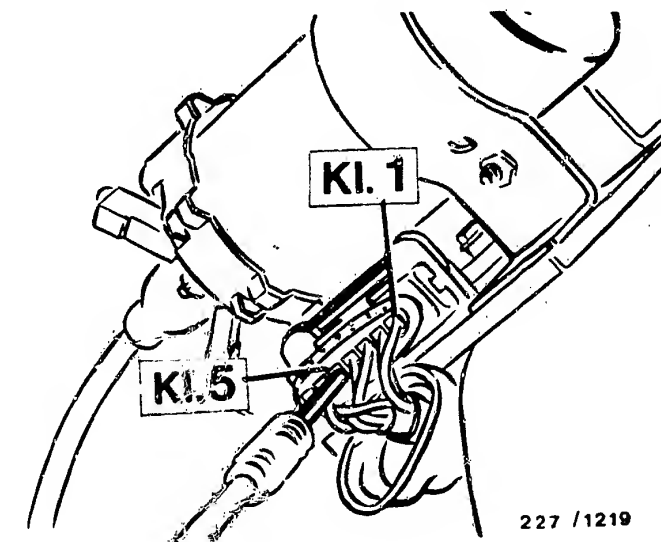
Oscilloscope must indicate rectangular pulse. See bottom picture.

Rectangular pulse present?

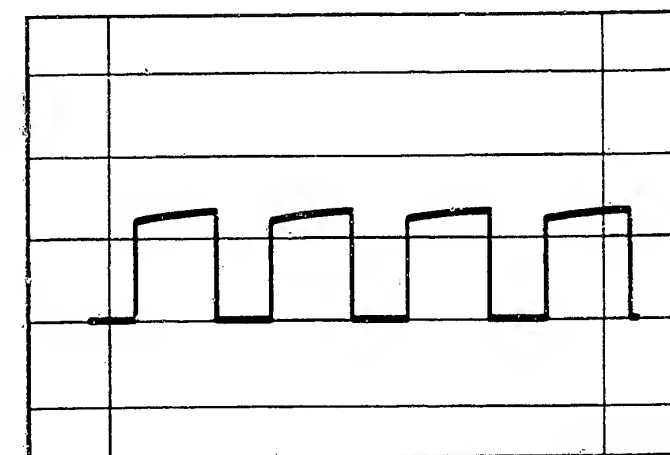
Detach ignition-distributor, trigger-box and ignition-advance-unit plug.

Return to trouble-shooting chart B04

Continued on next picture page



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227/0096

Consecutively connect ohmmeter to:

Ignition-
distributor
plug
(top picture)

Ignition-
advance-unit
plug
(center picture)

Term. 12 and term. 12

Ignition-
advance-unit
plug

Trigger-box
plug
(bottom picture)

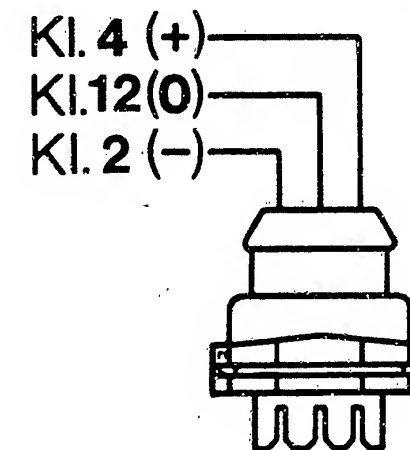
Term. 13 and term. 5

Set value approx. 0 Ω in each
case (continuity).

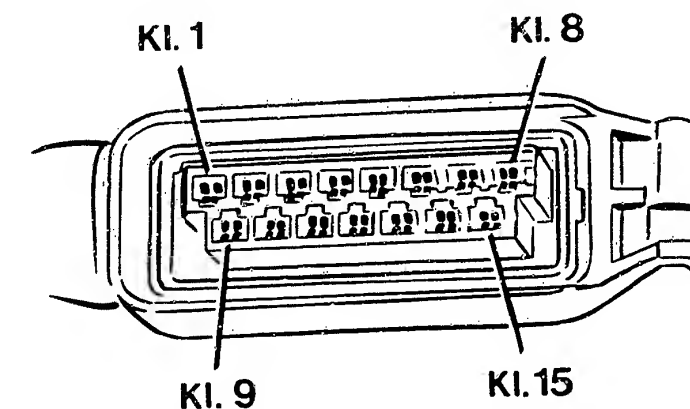
Eliminate open-circuit.

If there was no open-circuit, renew
ignition advance unit.

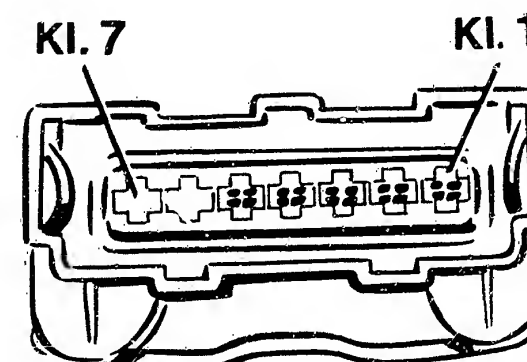
Return to trouble-shooting chart
B04



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TROUBLE-SHOOTING PROGRAM (10)

Test contact resistance (primary side).

Detach negative and positive lead of battery.

Detach trigger-box plug.
See picture.

Switch on ignition.

Test for contact resistance in leads from battery positive terminal to trigger-box plug term. 4 including leads from battery negative terminal to trigger-box plug term. 2.

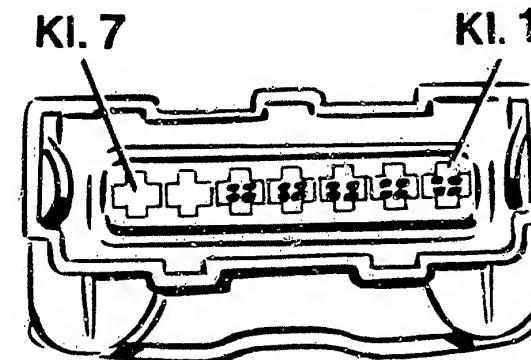
(Take account of resistance of test leads/test prods.)

Set value: see brief instructions

Is set value attained?

N>

Eliminate contact resistance.



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Continued on next picture page

TROUBLE-SHOOTING PROGRAM (10) CONTINUED (1)

Y

Test for contact resistance in leads from positive battery terminal to ignition coil term. 15 as well as in lead from ignition coil term. 1 to trigger-box plug term. 1.
See picture.
(Take account of resistance of test lead/test prods).

Set value: see brief instructions

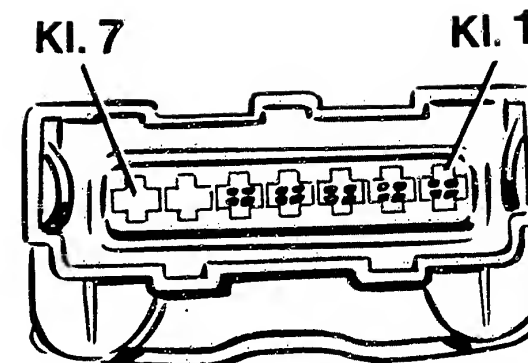
Is set value attained?

N>

Eliminate contact resistance.

Y

Return to trouble-shooting chart
B04



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TROUBLE-SHOOTING PROGRAM (11)

Test engine-speed signal.

Negative and positive lead of battery connected.
Trigger-box plug connected.

Detach LE-Jetronic control-unit plug.
See top picture.

Connect oscilloscope in program-selector-switch setting "Special" in accordance with operating instructions.

For example MOT 206:

Red clip to LE-Jetronic control-unit plug term. 15 (measurement signal).
See top picture.

Black clip to vehicle ground.

Start engine.

Oscilloscope must indicate rectangular pulse.

See center picture.

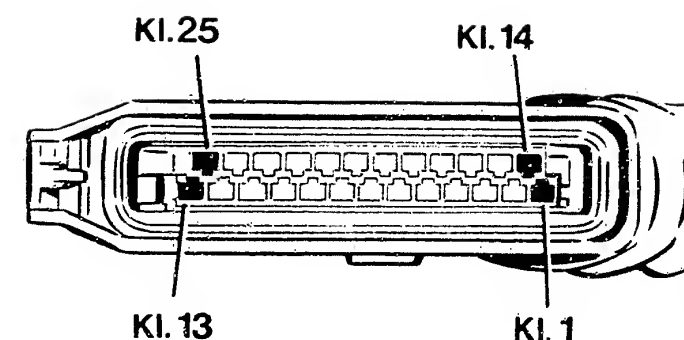
Rectangular pulse present?

N>

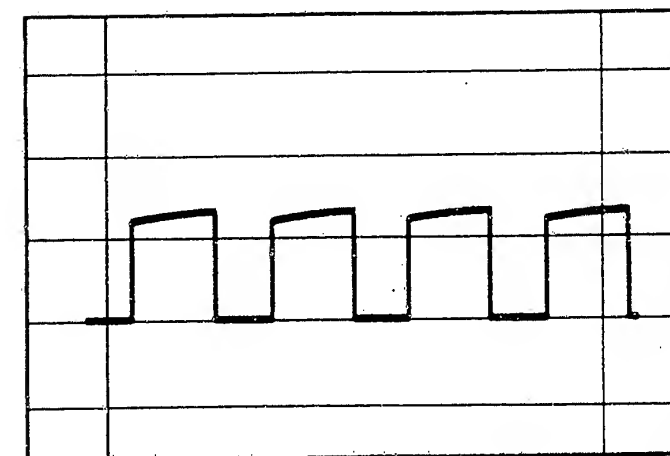
Test for open-circuit in lead from ignition-advance-unit plug term. 5 (bottom picture) to LE-Jetronic control-unit plug term. 15. See top picture.

Eliminate open-circuit.

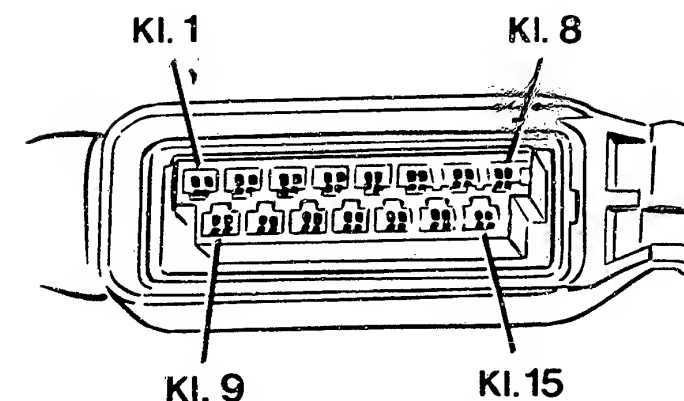
If there was no open-circuit, renew ignition advance unit.



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Return to trouble-shooting chart B04

C03

<=>

C04

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<=>

TROUBLE-SHOOTING PROGRAM (12)

V

Test primary signal.

Trigger-box plug connected.

Primary signal with oscilloscope

Connect oscilloscope as per operating instructions to ignition coil term. 15 (+) and term.1 (-).

Start engine.

Set value:
Oscilloscope must indicate a primary voltage (of any magnitude).
See picture.

O R

Primary signal with engine-speed tester

Connect engine-speed tester as per operating instructions to ignition coil term. 15 (+) and term. 1 (-).

Start engine.

Set value:
Engine-speed tester must indicate a value (irrespective of magnitude).

Primary signal present?

N>

Renew trigger box.

Y

V

Return to trouble-shooting chart
B04



TROUBLE-SHOOTING PROGRAM (13)

Test basic ignition setting.

Engine at operating temperature
(oil temperature approx. + 80° C).

Switch off ignition.

Connect Motortester in accordance
with operating instructions.

Detach throttle-valve-switch plug
and jumper (short) terminals 4, 5
and 6 with auxiliary lead
See top picture, arrow.

Run engine at 700...1000 min⁻¹.

If use is made of TDC sensor, read
off ignition angle/flash lamp on
to ignition marks.

Mark corresponds to 10°
BTDC.

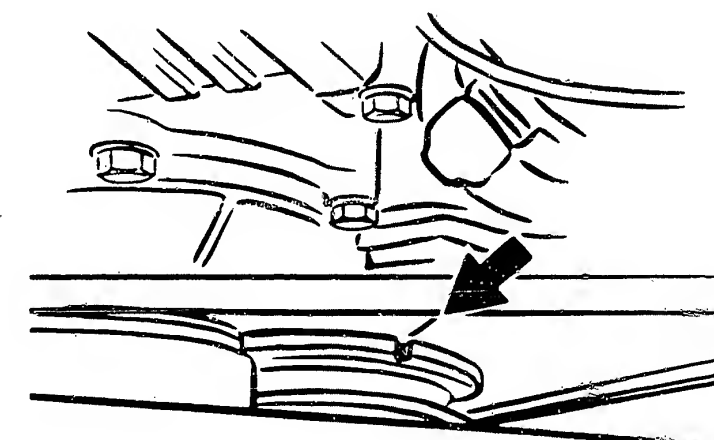
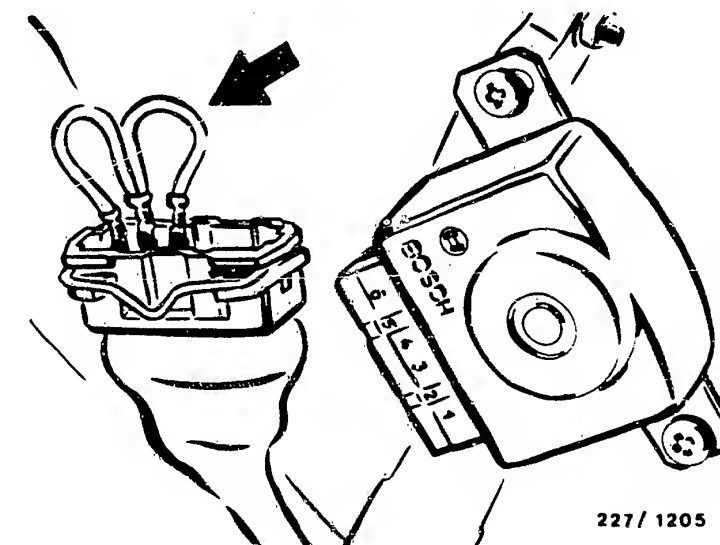
See bottom picture, arrow.

Set value: 10° ± 2° BTDC.

Is set value attained?

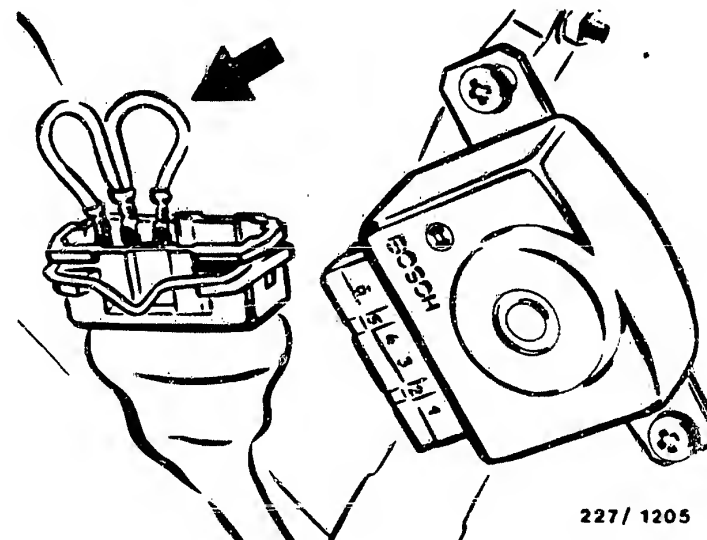
N>

Correct basic ignition setting by
turning ignition distributor.



Continued on next picture page

Remove jumper from term. 4, 5 and 6 of throttle-valve switch. See picture, arrow. Clear fault memory of transmission control. To do so, detach negative terminal of battery for approximately 1 minute (see SPECIAL FEATURES section for further information).



Return to trouble-shooting chart
B04

TROUBLE-SHOOTING PROGRAM (14)

Test control lead for characteristic-curve control.

Detach plug of temperature switch (oil) (top picture, arrow) and temperature switch (intake manifold) (center picture, arrow) and jumper both plugs in each case with auxiliary lead.

Detach ignition-advance-unit plug and connect voltmeter to term. 3 (+) and term. 7 (-).
See bottom picture.

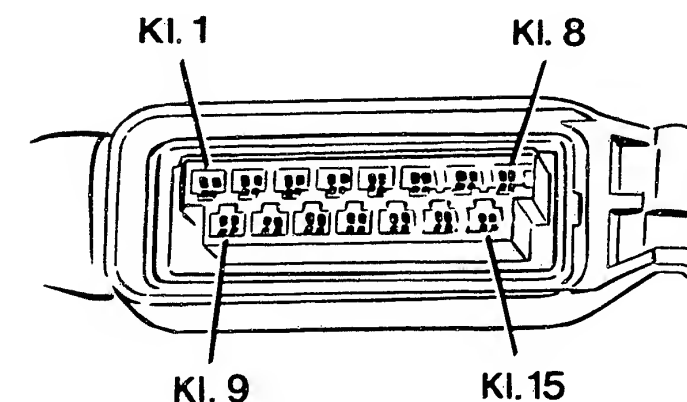
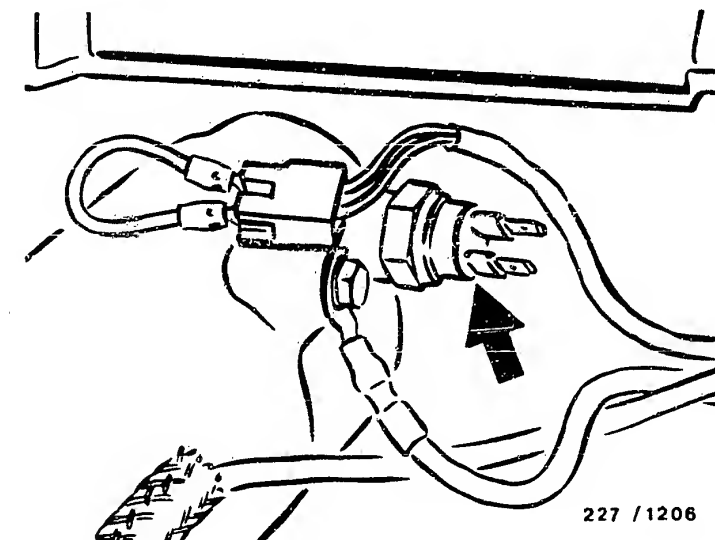
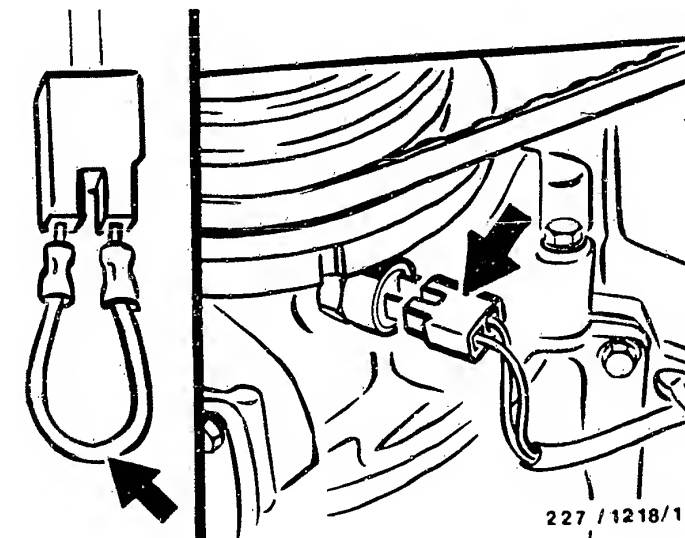
Switch on ignition.

Set value: Battery voltage

Is set value attained?

Return to trouble-shooting chart B04

Test for open-circuit in lead from ignition-advance-unit plug term. 7 to temperature-switch plug (intake manifold) via temperature-switch plug (oil) including ground connection.
Eliminate open-circuit.



TROUBLE-SHOOTING PROGRAM (15)

Test temperature switch (oil).

Temperature-switch plug detached.

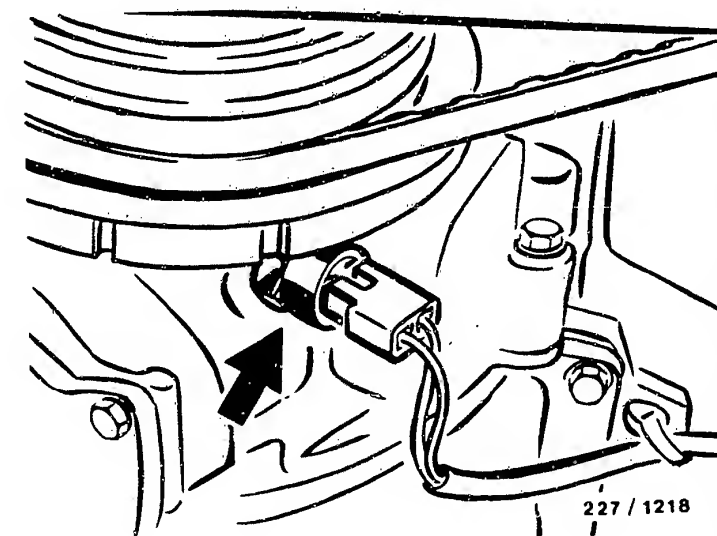
Connect ohmmeter to both connections
of temperature switch.
See picture, arrow.

Set value: See brief instructions

Is set value attained?

N>

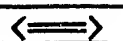
Renew temperature switch (oil).
(Tightening torque 25 Nm).



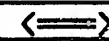
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Return to trouble-shooting chart
B04

C13



C14



TROUBLE-SHOOTING PROGRAM (16)

Test temperature switch (intake manifold).

Temperature-switch plug detached.

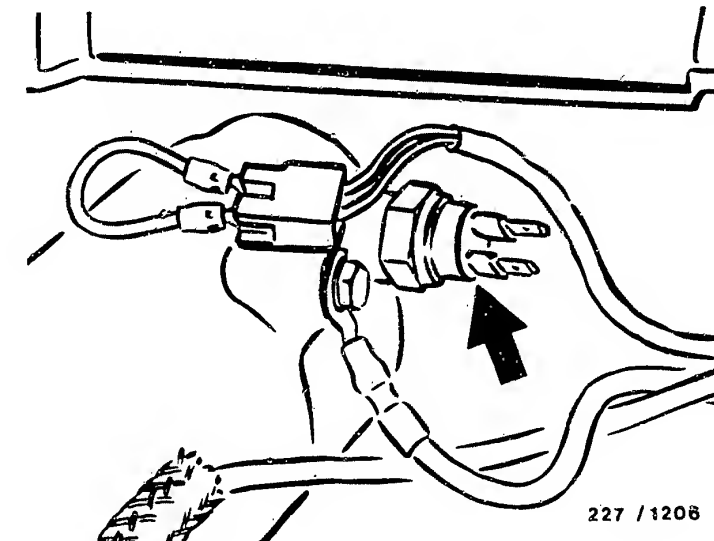
Connect ohmmeter to both connections of temperature switch.
See picture, arrow.

Set value: See brief instructions

Is set value attained?

Renew temperature switch (intake manifold).

Return to trouble-shooting chart B04



TROUBLE-SHOOTING PROGRAM (17)

Test throttle-valve switch, idle/full load.

1. Detach ignition-advance-unit plug and connect voltmeter to term. 6 (+) and term. 1 (-).
See top picture.
(throttle valve is in idle position).

B r i e f l y start engine.

Set value: approx. battery voltage.

2. Connect voltmeter to ignition-advance-unit plug term. 14 (+) and term. 1 (-).

Completely open throttle valve.

B r i e f l y start engine.

Set value: approx. battery voltage.

Is set value attained for item 1 and item 2?

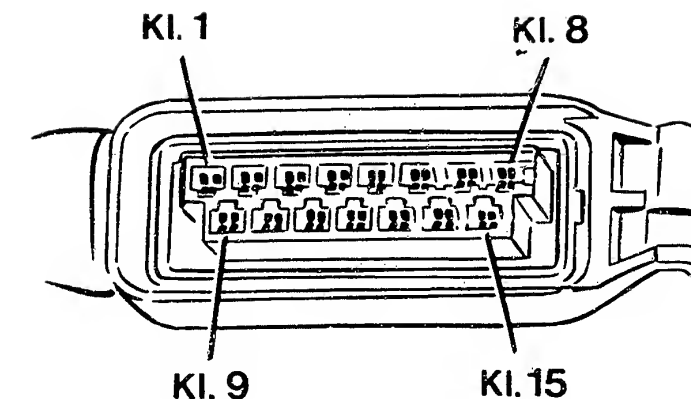
N>

1. Detach throttle-valve plug and connect ohmmeter to throttle-valve switch term. 4 and term. 6.
See bottom picture.
Throttle valve in idle position.
Set value: approx. 0 Ω
(continuity).

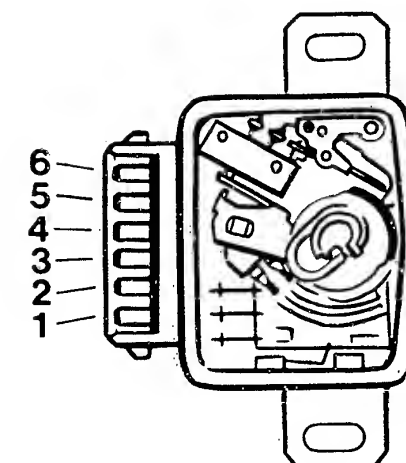
Throttle valve in part-load position.
Set value: infinity Ω
(open-circuit).
If set value is not attained, adjust throttle-valve switch.

P r o c e d u r e :
Loosen fastening screws of throttle-valve switch somewhat and turn throttle-valve switch until idle contact switches.
Set value: approx. 0 Ω
(continuity)
If set value is not attained, renew throttle-valve switch.
Tighten fastening screws of throttle-valve switch.

C h e c k :
Throttle valve in part-load position.
Set value: infinity Ω
(open-circuit)



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Return to trouble-shooting chart B04

Continued on next picture page

2. Connect ohmmeter to throttle-valve switch term. 4 and term. 5.

Depress accelerator pedal as far as it will go.

Set value: approx. 0 Ω
(continuity).

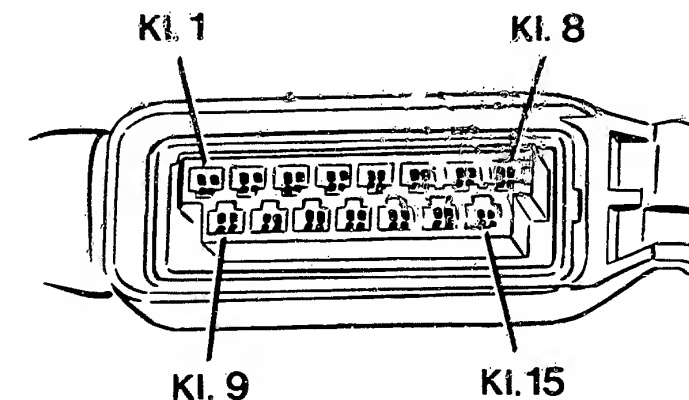
Release accelerator pedal (idle position).

Set value: infinity Ω
(open-circuit).

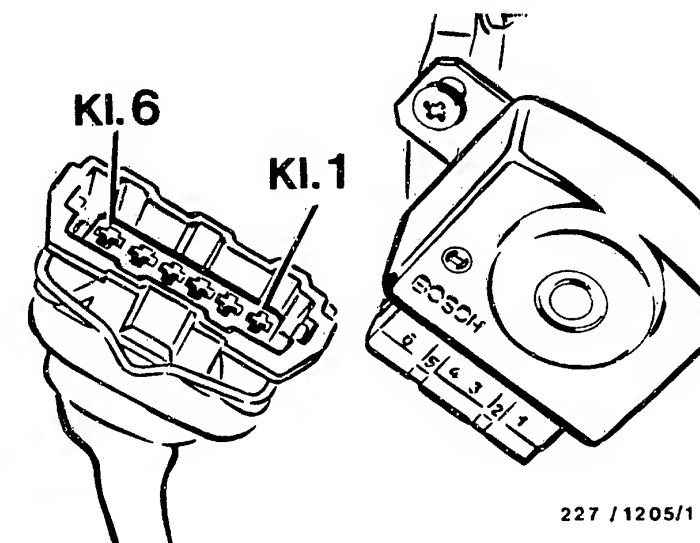
If set value is not attained, renew throttle-valve switch.

3. If test steps 1 and 2 were O.K., then test for open-circuit in lead connecting ignition-advance-unit plug term. 6 and term. 14 (top picture) to throttle-valve-switch plug term. 6 and term. 5 (center picture) and in lead from throttle-valve-switch plug term. 4 to control-relay plug-in frame term. 87 (bottom picture). Eliminate open-circuit.

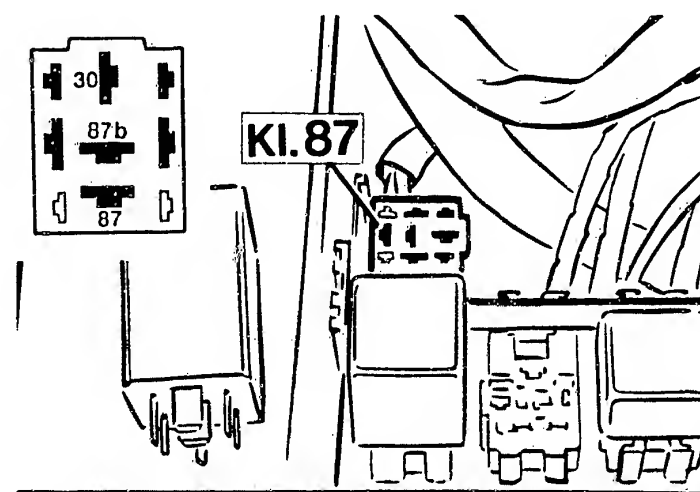
Return to trouble-shooting chart
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Test load signal
(with oscilloscope/dwell-angle
tester)

Detach ignition-advance-unit plug
and push back handle cover after
unscrewing fastening screws and
removing rubber seal.
See top picture.

Attach ignition-advance-unit plug.

Connect oscilloscope in program-
selector-switch setting "Special" in
accordance with operating
instructions.

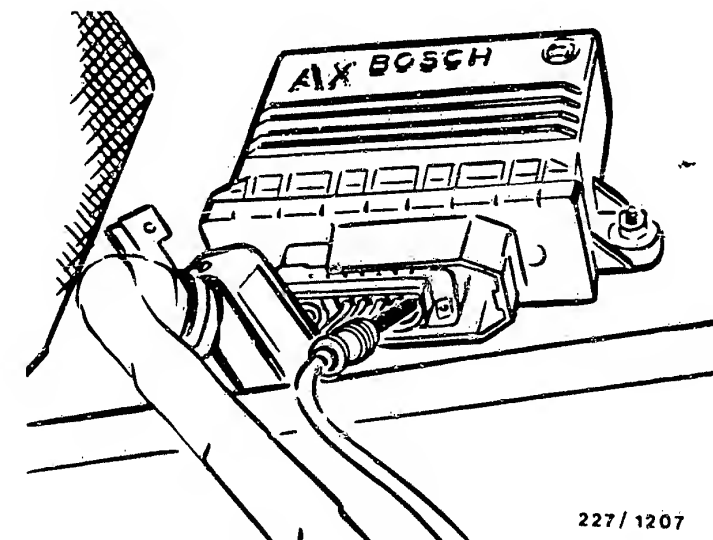
For example MOT. 206:

Red clip to ignition-advance-unit
plug term. 15 (measurement signal).
See top picture.

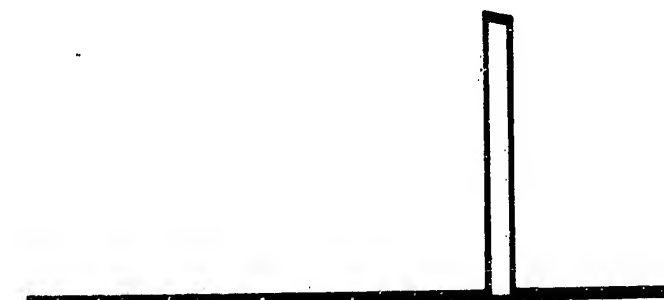
Black clip to vehicle ground.

Allow engine to idle.

There must be a load signal.
See bottom picture.



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Continued on next picture page

TROUBLE-SHOOTING PROGRAM (18) CONTINUED (1)

TESTING NOT NECESSARY IF TESTING
PERFORMED WITH OSCILLOSCOPE
(CONTINUATION IN NEXT BOX).

Connect dwell-angle tester in
accordance with operating
instructions:

For example:

Green clip to ignition-advance-unit
plug term. 15.

Yellow clip to battery positive.

Black clip to vehicle ground.

Allow engine to idle.

Read off and note down dwell angle.

Briefly accelerate to full throttle
and observe load signal.
There must be a noticeable change in
pulse duration.
See top picture, arrow.

When using dwell-angle tester, there
must be a noticeable change in the
previously indicated dwell angle.
Is there a change in pulse
duration/dwell angle?

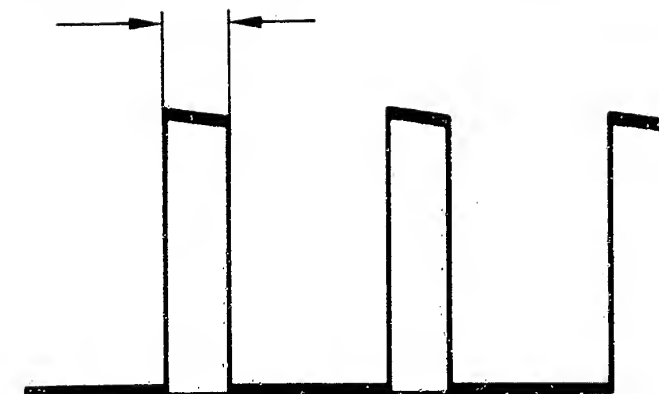
Return to trouble-shooting chart
B04

Detach ignition-advance-unit and
LE-Jetronic control-unit plug.

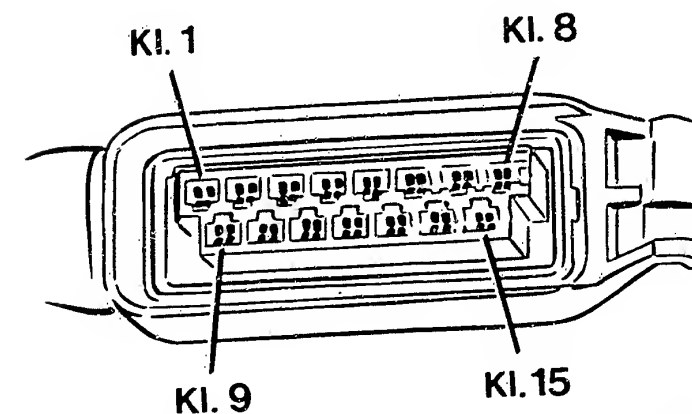
Test for open-circuit and
short-circuit to ground in lead from
ignition-advance-unit plug term. 15
(center picture) to LE-Jetronic
control-unit plug term. 6
(bottom picture).

Eliminate open-circuit/short-circuit
to ground.

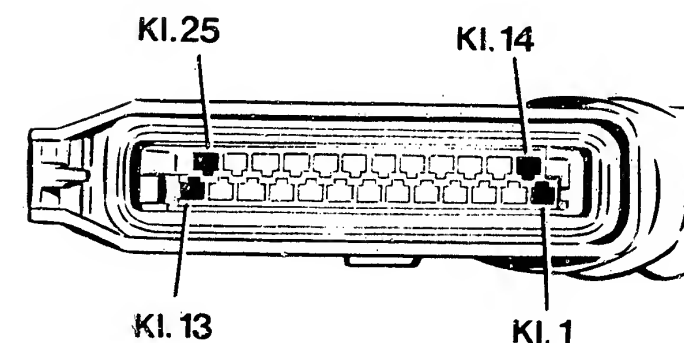
If there was no open-circuit or
short-circuit to ground, renew
LE-Jetronic control unit.



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TRUBLE-SHOOTING PROGRAM (19)

Test trigger-box voltage.

Unscrew ignition coil with heat sink.

Push back rubber sleeve of trigger-box plug and connect voltmeter to term. 4 (+) and term. 2 (-).
See picture.

Allow engine to idle.

Set value: 12...14 V or max. 1 V below battery voltage.

Is set value attained?

N>

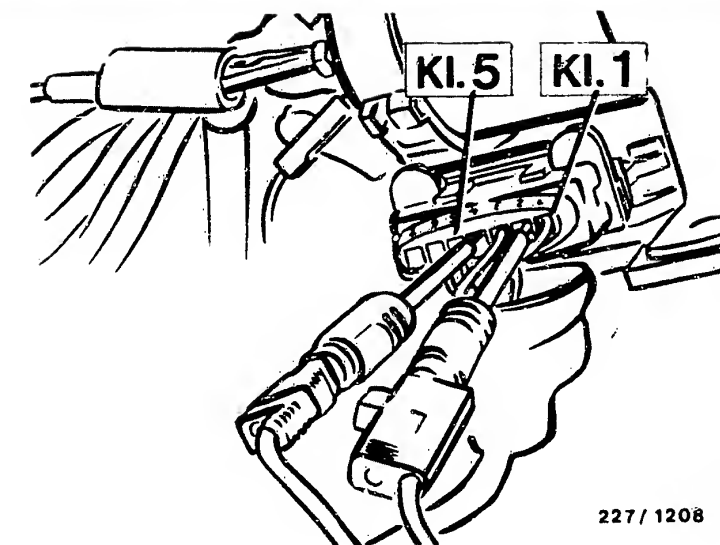
Disconnect negative and positive lead of battery.
Detach trigger-box plug.
Switch on ignition.

Check for contact resistance in following leads:

1. From battery negative terminal to trigger-box plug term. 2
2. From positive battery terminal to trigger-box plug term. 4

Contact resistance during testing of items 1 and 2 max. 0.3 Ω
(take account of resistance of test prods/test lead).

Eliminate contact resistances.



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Return to trouble-shooting chart
B04

TROUBLE-SHOOTING PROGRAM (20)

V

Test ignition-coil voltage.

Connect voltmeter to ignition coil term. 15 (+) and battery negative terminal (use connecting cable for ignition coil).

Allow engine to idle.

Set value: at least 10 V

Is set value attained?

N>

Disconnect positive lead from battery; switch on ignition.

Check for contact resistance in leads between positive battery terminal and ignition coil term.15.

Contact resistance may be max. 0.3 Ω (take resistance of test prods and test leads into account)

Eliminate contact resistance.

Y

V

Return to trouble-shooting chart B04

C27

<==>

C28

<==>

TROUBLE-SHOOTING PROGRAM (21)

Test primary voltage.
(If MOT series present)

Connect oscilloscope (e.g. MOT 206)
together with pulse-shaping circuit
1 684 463 154 to ignition coil as
per operating instructions.

N o t e :

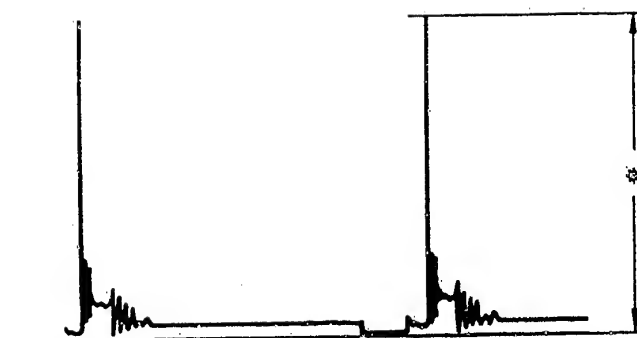
Incorrect measured value without
pulse-shaping circuit.

Allow engine to idle.

Set value: see picture/brief
instructions

Is set value attained?

Replace trigger box.

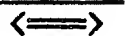


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* = See brief instructions

Return to trouble-shooting chart
B04

D01



D02



DANGER OF ACCIDENT ON SEMI-
CONDUCTOR IGNITION SYSTEMS

|22|
VDT-I-227/102 En
03.1981

Supersedes Feb. 3, 1976 edition

Please be sure to pass this bulletin together with VDE 0104/7.67 enclosed on to your employees for their attention.

The increased demands made on their ignition systems by modern engines, and the wish for freedom from maintenance, led some time ago to manufacturers starting to equip their vehicles with semi-conductor ignition systems as original equipment. In most cases, the performance of nearly all makes of such systems is higher than that of conventional systems, and further improvements are to be expected. This means that semi-conductor ignition systems have reached the point where contact with "live" components or terminals (whether on the primary side or the secondary side) can prove fatal.

In this connection, we should like to point out to you that the laws valid in your country regarding work on high-voltage systems must be adhered to when working on, or testing, semi-conductor ignition systems.

As a matter of principle, when working on such ignition systems, the ignition is to be switched off.

Included in such work are the following operations:

- * Connection of engine testing equipment (timing strobe, dwell-tach tester, ignition oscilloscope etc.)
- * Replacement of ignition system components (spark plugs, ignition coil, ignition distributor, H.T. ignition cables etc.)

If it is necessary to switch on the ignition in order to test the system or make adjustments on the engine (to the carburetor, for instance), then lethal voltages are present throughout the entire system.

This means that the danger of accident exists not only at the individual components in the system (e.g. ignition distributor, ignition coil, trigger box, ignition harness), but also at the wiring harness (e.g. connection for the tachometer, diagnostic connector), on terminals, and on test equipment.

In addition, in the case of the capacitor-discharge ignition system (CDI), danger of accident is also present under the following circumstances:

- * Operation of the trigger box without the ignition transformer.
- * At the trigger box, (removed), relatively soon after it has been switched off (capacitor discharge).

Below is a typical terminal diagram of a semi-conductor ignition system, the dangerous locations being marked with high-voltage arrows.

We would point out that all semi-conductor ignition systems, even the older versions, are to be regarded as dangerous in the sense as defined by this bulletin.

EFFECTS OF ELECTRICAL AND ELECTRONIC SYSTEMS ON HEART PACEMAKERS

VDT-I-227/107 En
01.1981

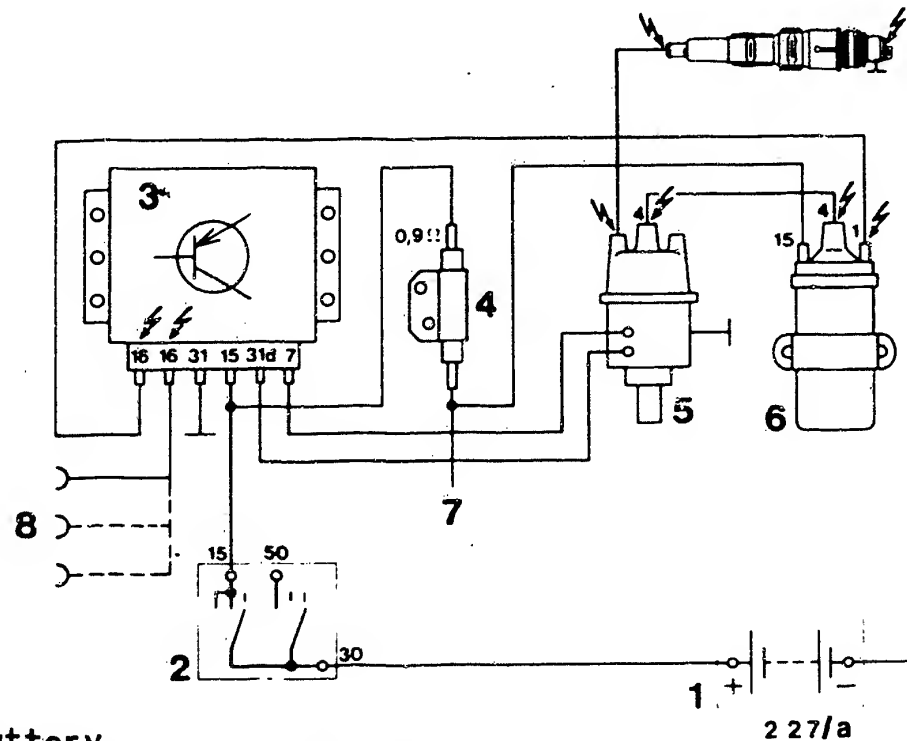
e.g. Ignition systems, Jetronic, Motronic, ABS

Please ensure that this Bulletin is passed
on to your employees for their attention.

We have often been asked by some of our
customers whether or not patients with heart
pacemakers are endangered in any way by
ignition systems. This theme was recently
the subject of an examination carried out by
the Ignition System Development Department of
Robert Bosch GmbH in conjunction with Dr.
Thull, lecturer at the Central Institute for
Biomedical Technology at the University of
Erlangen-Nürnberg and Biotronic GmbH & Co.
of Berlin, a manufacturer of heart pacemakers.
The magazine "Biomedizinischen Technik"
(5/80) published the results.

The most important discoveries in this practice
can be summarized from the examination report
as follows:

1. Heart pacemakers corresponding to the
latest state of the art are not affected
by radiation (electromagnetic fields) from
ignition systems.
2. With a stationary engine and the ignition
switched off, the heart pacemaker is not
affected by any part of the ignition system,
even when unintentionally touched. Main-
tenance work in the engine compartment, for
example, can then be carried out without
any danger.



- 1 = Battery
- 2 = Ignition/starting switch
- 3 = Trigger box
- 4 = Resistor
- 5 = Ignition distributor
- 6 = Ignition coil
- 7 = to starting motor term. 15a
- 8 = to tachometer connection
or diagnostic plug
or TD terminal

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

Please direct questions and comments
concerning the contents to our authorized
representative in your country.

3. With the engine running or stationary with the ignition switched on, touching current-carrying parts of the ignition system, as well as parts of any other electrical system, presents a certain danger for everybody. The heart pacemaker can here be affected under certain conditions (voltage, current and frequency). Patients with heart pacemakers should therefore at all costs avoid touching current-carrying parts of electrical systems.
4. Furthermore, patients with heart pacemakers are more inclined to psychic shock effects than other people, even when they receive just a harmless electric shock, because many such patients are conscious of the increased danger to the cardiac activity.

We therefore consider it inadvisable for patients with heart pacemakers to be employed in workshops or on vehicles where ignition systems are being tested or repaired. If any members of your staff have heart pacemakers, please introduce the necessary measures.

We would like to add that heart pacemakers are not expected to be affected in any way by interference from other electronic products and systems which we manufacture, such as the Antiskid System (ABS), Jetronic, Motronic, because the much greater radiation intensity of the ignition systems examined in normal use has not caused any interference to heart pacemakers corresponding to the latest state of the art.

If you should receive questions on this matter from customers, please inform them accordingly.

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

Please direct questions and comments concerning the contents to our authorized representative in your country.

TECHNICAL BULLETIN

NEW DESIGNATIONS FOR IGNITION SYSTEMS

VDT-I-227/108 En
01.1983
Supersedes 5.1981 edition

The introduction of new ignition systems has made it necessary to reclassify all designations.

The designations listed below will be used immediately in KH workshop and sales literature.

Designation	Abbreviated code	Meaning	Switching	Ignition ctrl. and spark adv.	High-voltage dist.
Coil ignition	ZS (CI)		Mechanical (breaker points)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Transistorized coil ignition	TSZ-K (TCI-c)	K=breaker-triggered	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Trigger box with conventional circuit techniques	TSZ-I * (TCI-i)	I=Induction-type pulse gen.	Electronic (trigger box)	Mechanical (ignition dist.)	Mechanical (ignition dist.)
	TSZ-H (TCI-h)	H=Hall generator	Electronic (trigger box)	Mechanical (ignition dist.)	Mechanical (ignition dist.)

Designation	Abbreviated code	Meaning	Switching	Ignition ctrl. and spark adv.	High-voltage dist.
Transistorized ignition	TZ-I * (TI-i)	I=Induction-type pulse gen.	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
(Trigger box in hybrid technique)	TZ-H * (TI-h)	H=Hall generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Breakerless semi conductor ignition with or without knock control	EZ (EI) (EZ-K) (EI-k)	K=Knock control	Electronic (trigger box or control unit)	Electronic (control unit)	Mechanical (ignition distributor or high-voltage distributor)
Distributorless ignition with or without knock control	VZ (FEI) VZ-K (FEI-k)	K=Knock control	Electronic (control unit)	Electronic (control unit)	Electronic (dual-spark ignition coil, or 1 ignition coil for each spark plug)

* Note:

The ignition system can also be equipped with a DLS unit (digital idle stabilization) or with an ELS unit (electronic idle stabilization) or with an ESV unit (electronic ignition retardation).

MOTOR VEHICLE SERVICE INFORMATION

INCORRECT DISPLAY OF ROTATIONAL SPEED VDT-I-Gen. 030 En
AND DWELL ANGLE ONLY WITH TRIGGER 02.1981
BOXES 0 227 100 ... (TCI-i, TCI-h)
WITH CURRENT LIMITATION Supersedes ed. 6.1980

For additional information, see VDT-I Gen. 032 En

1. General

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period, the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle when testing the ignition system. However, there is no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Incorrect displays may occur with the testers listed below:

MOT 001.00	Rotational-speed	KTE 001.00
001.01	display O.K. with	001.02
001.02	these testers	001.03
001.04		
002.00		

By now, the following vehicles may be fitted with breakerless ignition systems with current limitation:

Audi	(Bosch/Fairchild ignition system)	Mazda	(Mitsubishi ignition system)
BMW	(Bosch ignition system)	Mitsubishi	(Mitsubishi ignition system)
Citroen	(Delco ignition system)	Nissan	(Hitachi ignition system)
Fiat	(Delco ignition system)	Datsun	(Bosch ignition system)
Ford	(Delco ignition system)	Peugeot	(Bosch ignition system)
General Motors	(HEI ignition system)	VW	(Bosch/Fairchild ignition system)
		Bosch transistorized ignition system for retrofitting	
		0 227 100 920	

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2. Test instructions

2.1 Rotational speed

Incorrect rotational-speed display can be recognized as follows:

If one starts at the idle speed and slowly increases the engine speed, then the incorrect display can be recognized by an abrupt reduction in the rotational-speed display (e.g. from 2400 min^{-1} to 1200 min^{-1}).

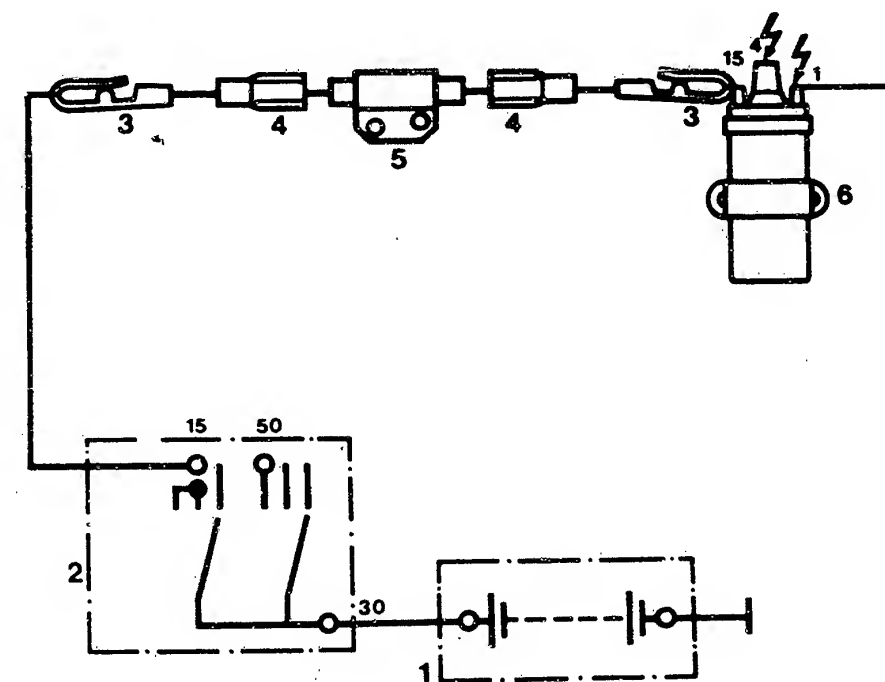
It is, however, possible to attain correct rotational-speed measurements:

Connect a ballast resistor of 0.9 or 1.0 Ohms (see Fig.) in series in the line to term. 15 of the ignition coil (take care not to cause a short circuit). After the rotational-speed measurement, the ballast resistor must be removed (otherwise starting difficulties and misfiring). Connect tester as per operating instructions.

Suggestion for user manufacture

Required parts:

1 ballast resistor 0.9 Ohms	Part no. 0 227 900 002
or	
1 ballast resistor 1.0 Ohms	Part no. 0 227 900 101
2 blade receptacles e.g. approx. 0.2 m cable, 1.5 mm ² e.g.	Part no. 1 901 355 881
2 insulated clips	Part no. 6 210 150 150
	Commercially available



- 1 = Battery
2 = Ignition/starting switch
3 = Terminals
4 = Blade receptacle
5 = Series resistor
6 = Ignition coil

2 27/d

Danger arrows: Warning: 400 V...25 KV

2.2 Dwell angle

The dwell angle is electronically controlled.
The dwell angle is no longer measured.

2.3 Ignition timing

Is correctly indicated. Tester connections according to operating instructions.

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MOTOR-VEHICLE SERVICE INFORMATION

MOTORTESTER CONVERSION

VDT-I-Gen. 032 En

Incorrect indication of engine speed,
dwell angle and ignition point
only with trigger boxes

06.1980

0 227 100 .. (TCI-I, ICI-H) with current limitation

For additional information see

VDT-I-Gen. 030 of 06.1980

Concerns: Motortester EFAW 268

268 S 10

269

214 B

AE 2000

1. General

Please arrange for above-quoted motor-testers in your workshop as well as at your customers (e.g. motor-vehicle workshops, petroleum companies, gas stations, vocational schools etc.) to be converted. Conversion is subject to payment and is performed by the K7 after-sales service of the responsible BG. The standard time is 15 work units (with installation of switch).

2. Why convert motortesters?

Transistorized ignition systems with current limitation have a different primary-voltage characteristic from conventional ignition systems. During the dwell period, the voltage at terminal 1 of the ignition coil may assume values between 1.5 V and battery voltage (or greater), which, when checking the ignition system, may lead to an incorrect indication of engine speed and dwell angle and to incorrect triggering of the counter.

There is, however, no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Since, with the above-listed motortesters, the timing strobe is triggered by the signal-path dwell-angle meter, this incorrect triggering also leads to incorrect flashing and thus to an incorrect display of the advance angle.

3. Conversion measures

The situation is to be remedied by modifying the wiring of the testers so that the timing strobe is triggered by the clamp-on induction pickup and the pulse shaper stage.

By fitting the switch with change-over contact in the front panel of the motortester, it is possible to switch over from standard ignition systems to those with current limitation. We recommend that the switch positions be marked correspondingly:

e.g. "Standard" - "Current limitation".

These conversion measures have already been published in the K7 information sheet KJF 28/7911.

4. Test instructions

4.1 Standard ignition systems

Switch position: "Standard".

All other tester connections as per operating instructions.

4.2 Ignition systems with current limitation

Switch position: "Current limitation".

In order to trigger the timing strobe, the induction-type pulse generator (clamp-on pickup or red pickup) must always be connected during the measurement.

The selector switch for ignition systems built into the motortester must be switched to standard coil ignition (not to TCI) with these ignition systems.

All other tester connections as per operating instructions.

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.

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MOTOR VEHICLE SERVICE INFORMATION

TESTS ON ELECTRONIC IGNITION SYSTEMS (TCI, TI) TESTER INSTRUCTIONS

VDT-I-Gen. 035 En
03.1981

The following tests are listed in older and current Tester operating instructions or in "Trouble-shooting with the oscilloscope":

- * "Separate ignition coil test"
(Concerns EFAW 213, 214, 268, AE 2000)
- * Calculating the "ignition voltage reserve"
(Concerns EFAW 213, 214, 268, AE 2000 and MOT series).
- * "Intensified insulation test"
(Concerns EFAW 213, 214, 268, AE 2000 and MOT series).

Nowadays, transistorized ignition systems deliver more than 30,000 V secondary voltage.

To avoid damage to ignition coil, ignition cable and ignition distributor by voltage flashovers, the tests listed above should not be carried out on transistorized ignition systems.

The contents of this Service Information has already been published in the K7 Information K7-VJF 17/8012.

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